

2015 Fall Chinook Salmon Spawning Ground Survey

Salmon-Scott Rivers Ranger District
Klamath National Forest



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ABSTRACT

Cooperative spawning ground surveys between the U.S. Forest Service, California Department of Fish and Wildlife, Yurok Tribe, Karuk Tribe, Quartz Valley Indian Reservation, Salmon River Restoration Council, and local schools and volunteers have occurred on the Klamath National Forest since 1992. In addition to providing information to land managers in regard to where these fish spawn, these surveys are used to estimate the total in-river spawner escapement of Fall Chinook salmon (*Oncorhynchus tshawytscha*) by the Klamath River Technical Team and the Pacific Fisheries Management Council for determination of harvest allocations for the subsequent year.

The Salmon River and Scott River are surveyed on an annual basis using both carcass mark-recapture and redd count techniques. Mark-recapture of carcasses (and in some cases, redd counts) are used for population estimations. Redd counts are utilized on the rivers' tributaries, which may not be regularly visited during the spawning season. The 2015 cooperative survey began October 12th and ended December 17th. All scheduled surveys were completed on Scott River and Salmon River. Both drainages exhibited low discharge as a result of a multi-year drought; and fall freshets and larger precipitation events did not occur until the end of the spawning season, extending low flow conditions beyond their normal period. The response of fish was to alter their spawning distribution, particularly in the Scott River watershed. Surveys in both drainages also included tributary visits.

Approximately 2,070 fish returned to the Salmon River and 2,113 fish returned to the Scott River. Run estimates, made by California Department of Fish and Wildlife, are compiled through a combination of redd count and mark-recapture carcass surveys. The Scott River also employs weir videography. Using data collected since initiation of organized surveys in 1978, year 2015 returns are below average for both Salmon River [ranked 23rd (of 38 years)] and Scott River [ranked 34th (of 38 years)].

INTRODUCTION

Since 1978, the California Department of Fish and Wildlife (CDFW) has determined Fall Chinook salmon spawner escapement in the Klamath River watershed using a combination of weirs, mark-recapture surveys, redd surveys, and hatchery return information. This data is used in the determination of stock size projections for the management of Klamath River Fall Chinook salmon stocks by the Klamath River Technical Team and the Pacific Fisheries Management Council.

The CDFW, Klamath National Forest (KNF), and Six Rivers National Forest (SRNF) (the Forests are hereafter collectively referred to as USFS) have conducted Chinook spawner surveys for many years. Since missions differ among agencies, the objectives for these surveys were always slightly different. The USFS traditionally counted redds and live fish in order to estimate number and distribution of spawning Chinook salmon. Beginning in 1992, CDFW and USFS joined together to accomplish spawner escapement surveys, partially due to shrinking budgets in both State and Federal programs, but also the desire to increase cooperative operations between agencies. These surveys now include collaboration with the Karuk Tribal Government, Yurok Tribal Government, Quartz Valley Tribal Government, Salmon River Restoration Council, Scott Valley Resource Conservation District, Mid-Klamath Watershed Council, Northern California Resource Center, and local volunteers and public schools. The cooperative effort has improved the accuracy of CDFW estimates by enabling surveys that are more extensive and frequent in nature.

In fall 2015, a combination of redd and mark-recapture counts were completed in the Salmon River and Scott River drainages, including mainstems and tributaries, in order to determine Fall Chinook spawner escapement and distribution (**Table 1**). This report summarizes redd count surveys conducted from October 12th through December 17th on the KNF portion of the Salmon and Scott Rivers (i.e., within the Salmon-Scott Rivers Ranger District [SSRD]). The exception of this is Wooley Creek and the Salmon River below Nordheimer Creek, which were surveyed by SRNF personnel. Data from these locations is covered in documents produced by SRNF.

A separate report is prepared by CDFW biologists for the escapement estimates to be used by the fisheries management councils. A portion of the Fall Chinook MegaTable as compiled by the CDFW has been included in **Appendix A** (CDFW 2015a).

Table 1. The 2015 survey schedule for KNF crews for the Salmon River and Scott River.

Survey Week	Scott River (Monday)	Salmon River (Tuesday)		Scott River (Thursday)	Salmon River (Friday)
1	Oct-12 (ns - holiday)	Oct-13	No surveys on Wednesday	Oct-15	Oct-16
2	Oct-19	Oct-20		Oct-22	Oct-23
3	Oct-26	Oct-27		Oct-29	Oct-30
4	Nov-02	Nov-03		Nov-05	Nov-06
5	Nov-09	Nov-10		Nov-12	Nov-13
6	Nov-16	Nov-17		Nov-19	Nov-20
7	Nov-23	Nov-24		Nov-27 (ns - holiday)	Nov-28 (ns - holiday)
8	Nov-30	Dec-01 (Last day Salmon)		Dec-03	Dec-04
9	Dec-07 (Last day Scott)	Dec-08		Dec-10	Dec-11
10	Dec-14	Dec-15		Dec-17 (Scott - R8 only [CDFG])	Dec-18

*ns - no survey

METHODS

In 2015, redd surveys were conducted on the Salmon River and Scott River, as well as various tributaries. **Table 2** summarizes each reach for 2015, including reach number and length, number of times surveyed, and total number of redds counted over the course of the survey season.

- Salmon River was surveyed once to twice weekly from mile marker 10 on the North Fork (NF) to the confluence with the South Fork (SF); Matthews Creek campground on the SF to the confluence with the NF; and the mainstem Salmon River from the confluences to Nordheimer Creek. The mainstem below Nordheimer Creek and Wooley Creek were surveyed on a differing schedule by SRNF personnel, and is detailed in a separate report.
 - The NF also included occasional surveys from mile marker 12 to mile marker 10.
 - Tributaries surveyed included Knownothing Creek, Little North Fork Salmon River, Methodist Creek, and Nordheimer Creek.
- Scott River was surveyed from below Meamber Bridge to the confluence of the Klamath River.
 - Surveys are normally conducted in the Scott Valley, with Scott Valley Resource Conservation District as the lead entity to liaise with local landowners. However, Chinook never made it to the Scott Valley reaches due to exceptionally low discharge conditions which resulted in large stretches of dry riverbed within the valley, as well as rendered largely impassible many beaver dams and natural low-flow barriers which are normally able to be traversed.

- Surveys also included canyon tributaries of Canyon Creek, Kelsey Creek, and Tompkins Creek.

The USFS and CDFW held two training sessions for agency employees, Tribal employees, and volunteers. On October 7th, the redd survey/carcass mark-recapture training was held at Indian Scotty Group campground on the Scott River. Similar training was held at Oak Bottom River Access on the mainstem Salmon River on October 6th. Topics discussed at the trainings incorporated redd and fish identification; carcass marking, including the explanation of mark-recapture estimates; scale and otolith sampling; data collection; salmonid life cycles; and survey safety procedures.

Table 2. Fall Chinook spawning survey reach descriptions for Salmon River and Scott Rivers in 2015. Salmon River reaches surveyed by Six Rivers National Forest not included.

Stream Name	Reach Name	Reach Number	Miles	Number of Times Surveyed ¹	Total Number of Redds Surveyed...
Salmon River					
Mainstem	Otter Bar to Nordheimer Ck	4A	1.6	13	84
	Forks of Salmon to Otter Bar	4B	2.4	14	131
North Fork	Mile 2 to Forks of Salmon ²	9A	2.0	12	82 (6)
	Mile 4 to Mile 2	9B	2.0	12	52
	Mile 6 to Mile 4	10A	2.0	10	6
	Mile 8 to Mile 6	10B	2.0	8	27
	Mile 10 to Mile 8	11A	2.0	5	10
	Mile 12 to Mile 10	11B	2.0	2	2
South Fork	Henry Bell to Forks of Salmon	5A	3.0	13	84 ³
	O'Farrill Gulch to Henry Bell	5B	2.0	13	67
	Indian Ck to O'Farrill Gulch	6A	3.0	12	47
	Matthews Ck to Indian Ck	6B	2.2	12	35
Tributaries	Knownothing Creek (incl. 0.3 mi WF)		2.8	2	0
	Little NF Salmon River	A (lower)	2.3	1	0
	Methodist Creek		2.4	2	0
	Nordheimer Creek	A (lower)	1.8	2	17
Scott River					
	Midpoint to Confluence	1	2.5	16	109
	"Cabin Hole" to Midpoint	2	2.5	13	128
	George Allen to "Cabin Hole" ⁴	3	3.0	15	127 (12)
	Tompkins Creek to George Allen	4	2.5	13	79

Stream Name	Reach Name	Reach Number	Miles	Number of Times Surveyed ¹	Total Number of Redds Surveyed...
	Bridge Flat to Tompkins Creek	5	4.0	16	117
	CDFW Weir to Bridge Flat	6	3.8	14	183
	USGS Gauge to CDFW Weir	7	3.5	6	26
	Shackleford Creek to USGS Gauge	8	2.9	3	25
	Dunlap to Meamber Bridge	9	3.0	0	Not surveyed
	Hwy 3 to Dunlap	10	3.0	0	Not surveyed
	Eller Lane to Hwy 3	11	7.0	0	Not surveyed
	Sweezy to Eller Lane	12	2.5	0	Not surveyed ⁵
	Horn Lane to Sweezy	13	3.0	0	Not surveyed ⁵
	Young's Dam to Horn Lane	14	2.0	0	Not surveyed ⁵
	Fay Lane to Young's Dam	15	3.5	0	Not surveyed ⁵
	Callahan to Fay Lane	16	6.7	0	Not surveyed ⁵
Tributaries (Canyon)	Canyon Creek		1.3	2	0
	Kelsey Creek (including spawning channel)		0.6	2	11
	Tompkins Creek		2.5	1	0

¹Flagging marking redds may have been removed prior to end of carcass surveys. "Times Surveyed" includes ALL surveys, even those performed end-of-season when redds may have been no longer counted.

²Several locations may not flagged due to crew safety concerns (Reach 6A) or request to avoid a redd concentration area by adjacent landowner (Reach 9A). Numbers in parenthesis is maximum number of unflagged redds observed from bank during a single survey and not accounted for via GPS.

³Reach 5A (Henry Bell to Forks of Salmon) is not flagged. Number reported is the maximum number of observed redds (10/23/15).

⁴Portions of private property in Reach 3 of Scott River not flagged, although property was still traversed. Numbers in parenthesis is the maximum number of unflagged redds.

⁵Scott River reaches 12 through 16 and valley tributaries were not surveyed in 2015 due to drought conditions preventing spawning fish from reaching this portion of the Scott River drainage.

On the Salmon and Scott Rivers, crews conducted two concurrent protocols on survey reaches, using redd counts and carcass counts (CDFW 2015b). A typical crew consisted of two people. Each crew walked two to four miles of river each survey day unless health or safety concerns limited ability to survey. The number of times a reach was surveyed was directly related to the number of people available on the survey dates. When a lack of available surveyors was a concern, the reaches to be surveyed were determined by the level of activity observed on the prior survey date and personnel knowledge of the system. Access to private land was also a limiting factor on the Scott River. An attempt was made to have people survey different reaches throughout the season so as to reduce estimator bias.

On both rivers, all redds were counted, flagged, and location marked on a topographic map, with total number of redds tallied at the end of each reach. Reaches where redds were not marked due to safety or landowner preference regarding flagging on their property are listed below. Additionally, redds (where flagged) were characterized as to size (width/length) and habitat type in which it was observed. Throughout the season redds were GPSed. Original field maps of redd locations are available at the Salmon-Scott Rivers District Office in Fort Jones, CA.

- Salmon River, not flagged – Reach 5A; canyon segment of 6A; redd concentration at Pollocks Gulch [9A] (at request of concerned adjacent landowner)
 - Due to low water conditions, some crews were able to access the Reach 6A canyon segment safely
- Scott River, not flagged – portion of Reach 3 in front of a landowner's house

RESULTS

Salmon River

Overall effort on the Salmon River was very good. Low flow conditions were present through most of the spawning season as a result of multiple drought years, poor winter snowpack/run-off, and delay to early-December of the larger fall precipitation events which normally occur in late-October. The freshets which did occur during the survey period did not appreciably raise the discharge until the end of the spawning season, at which time most fish had already completed redd construction (**Appendix B**). Furthermore, several major tributaries which normally support spawning fish – Knownothing Creek, Little North Fork Salmon River, Methodist Creek – did not have fish this year because access through the mouth was limited or not possible at the existing discharge. Surveys upon the North Fork were cancelled one day in early November following a rainstorm which caused highly turbid conditions. The turbidity resulted from mobilization of fine sediments deposited throughout the North Fork following landslides in the Music/Highland Creeks tributary drainage triggered by a summer thunderstorm sited over an area of high burn severity from the 2014 Whites Fire.

The Salmon River probably reached peak spawning in early- or mid-October. Specific dates cannot be determined because spawning activity was well underway by October 13th when the first redd counts were performed. In most years since detailed reporting of survey efforts upon the SSRD began in 2010, the temporal pattern for the Salmon River is for spawning to be heavy at the surveys start, with a subsequent decline in number of new redds thereafter, except when a freshet may trigger an uptick. In 2015, the level of new spawning instances appeared to be fairly constant in October (disregarding the first survey day), with a slow trailing through November. Overall survey effort was affected by number of surveyors available, weather, and flows. See **Appendix C** for a table of redd numbers organized by reach and date.

Specific areas of the Salmon River display a greater preference for use by spawning Fall Chinook. Five years of mapping redds by GPS (with hardcopy map back-ups) is revealing patterns. There are areas which show annual use at low densities, as well as scattered redds which likely represent opportunistic use of habitat which may be locally limited in extent. There are also sites which, within the last five years, have shown heavy use only once (and light or no use otherwise), which may indicate exploitation only when certain conditions are met, such as water flow or fish return numbers.

The GoogleEarth redd overlay will not be updated for 2015 due to drought conditions persisting through the spawning season and substantially altering use patterns as observed 2011 to 2014. Annual updating of the general dataset will continue in 2016, omitting the 2015 dataset as an outlier. Spawning seen in 2015 will be set aside for inclusion in a “low water distribution” map database, to be compiled at a future date. Acquisition of new data (under conditions which do not include exceptional drought) will better refine identified concentrated use areas, as well as define other sites with consistent, but lighter, use. In particular, additional data is needed to determine the trigger conditions for spawning grounds with occasional, yet heavy, utilization.

See the “Discussion” section for a discussion on changes in spawning use patterns during years of exceptional low water.

Focus for the dataset is upon locales which exhibit multiple years of use at moderate or greater density of redds. Specifically, “concentrated use areas” are defined as redd groups which, within at least two of the previous four years (not inclusive exceptional drought years), have possessed a minimum density of 6 redds within an approximate 100 meter linear distance.

- Mainstem Salmon River (Nordheimer Creek to Forks of Salmon – ~4.0 miles)
 - 11 concentrated use areas
 - Notable sites (downstream to upstream) include upstream of Otter Bar; Horn Field; and the river access at Forks of Salmon (below the school).
- North Fork Salmon River (Forks of Salmon to Kelly Gulch – ~12.0 miles)
 - 18 concentrated use areas
 - Notable sites (downstream to upstream) include Forks of Salmon from Post Office to mouth; Pollocks Gulch vicinity; and Red Bank engine access.
- South Fork Salmon River (Forks of Salmon to Matthew Creek – ~10.2 miles)
 - 25 concentrated use areas
 - Notable sites (downstream to upstream) include upstream from Knownothing Creek; Hotelling Gulch vicinity; approximate river mile 4.3; County Road 1C02 river crossing downstream of O’Farrill Gulch; downstream/upstream of Methodist Creek; and Matthews Creek vicinity.

In 2015, fish distribution was broadly similar to previous years. However, there were differences with spawning at some concentrated use areas being lighter than years past, else spatially shifted upstream/downstream. Notably, use of South Fork above the canyon in Reach 6A was much lighter than past years, which could indicate that the cascades in this segment may function as an impediment to upstream movement during very low discharge.

Amongst all reaches for 2015, those with over 100 redds include 4B (mainstem). See **Appendix D** for redd spatial distribution and density information.

Using survey data, the Salmon River is estimated to have had 2,070 fall-run Chinook salmon return in the fall of 2015 (**Figure 2; Appendix A**). Based on long-term tracking data compiled by CDFW, 2015 was below average, ranking 23rd (of 38 years) for run size.

Figure 1. Fall Chinook redds observed and survey effort on the Salmon River in 2015. Surveys occurred (maximum 12 reaches available) on NF Salmon River from Mile 12 to Forks of Salmon; on SF Salmon River from Matthews Creek to Forks of Salmon; and on the mainstem Salmon River from Forks of Salmon to Nordheimer Creek.

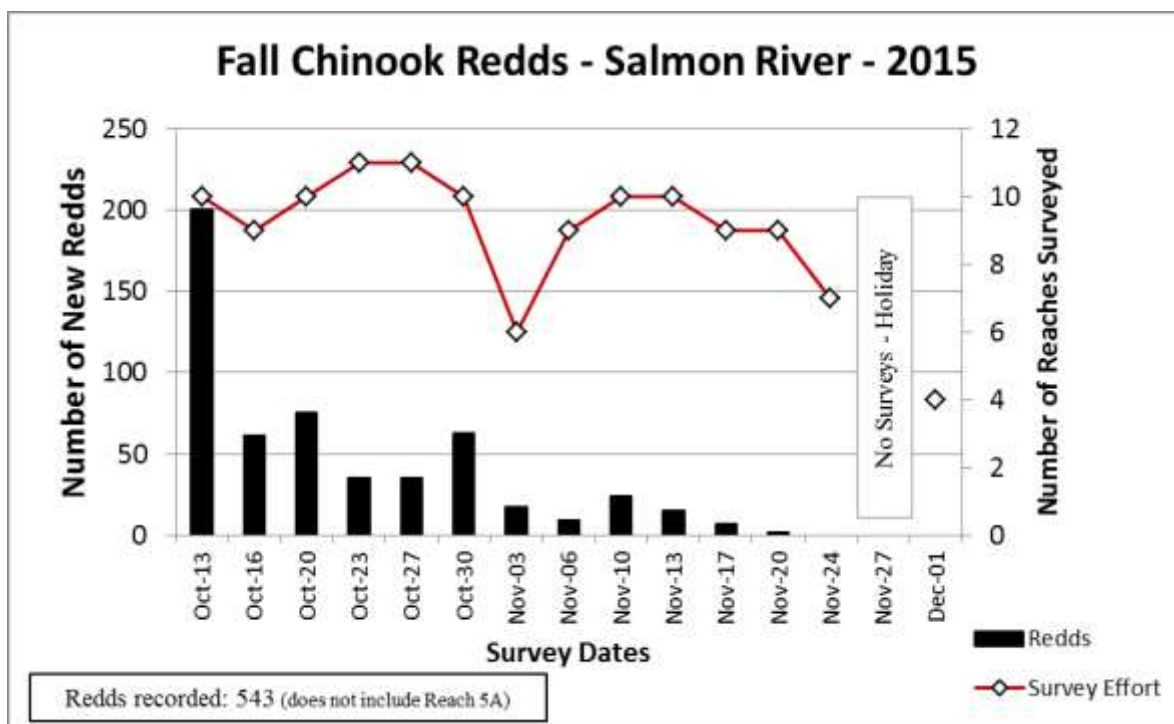
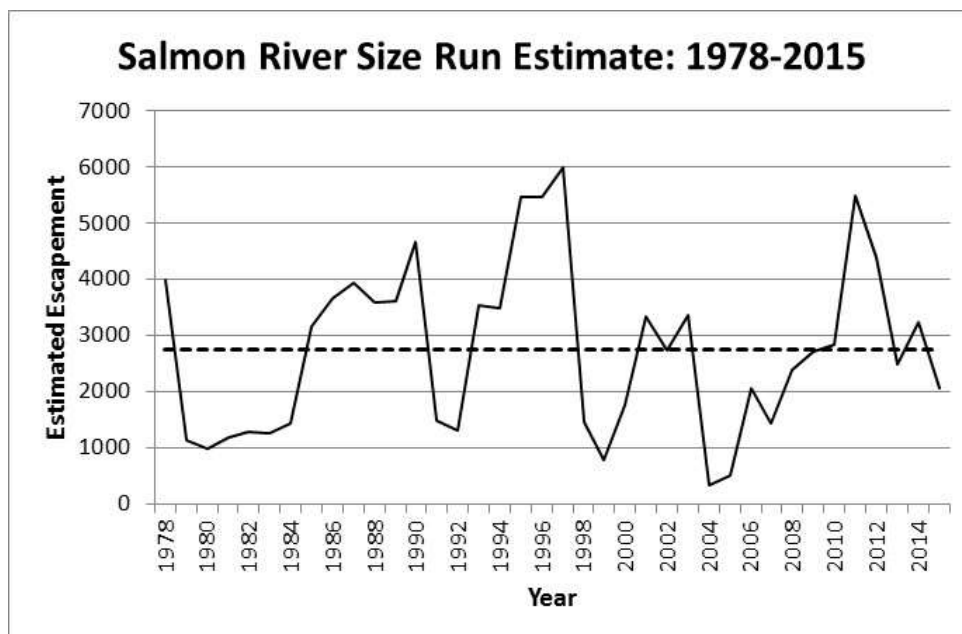
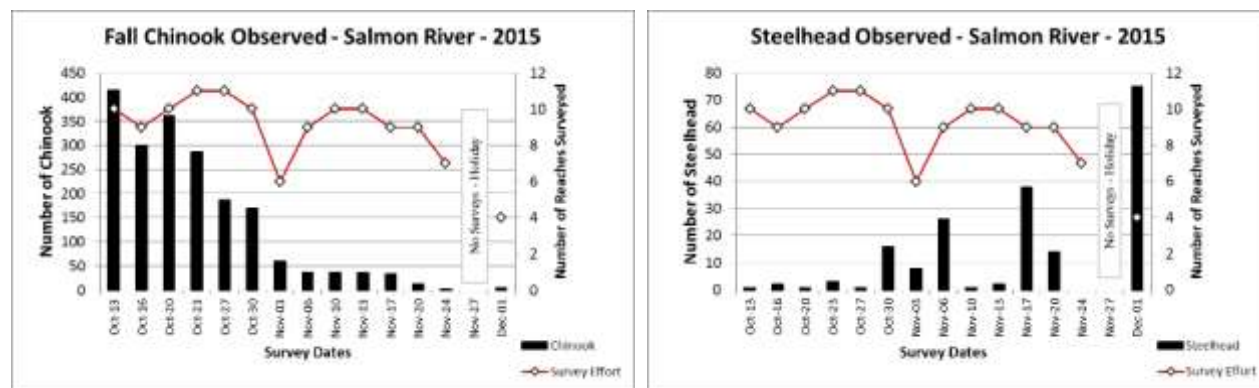


Figure 2. Salmon River fall-run size estimates for 1978 to 2015. Dashed line is average over long-term survey period.



Live Chinook and steelhead were tallied during surveys (**Figure 3**). As with redds, survey effort is impacted by high flow; and fish observation is affected by number of surveyors, weather, discharge conditions, and surveyor experience. Peak live Chinook were observed on October 13th, with subsequent numbers declining within the survey area. Similar to redd results, true peak cannot be definitely determined because fish were already very active upon the spawning grounds at the commencement of surveys. Steelhead were variable, with the most observed on December 1st. Changing flow conditions is considered to be one of the triggers for steelhead movement. Steelhead seemed to be observed more frequently in association with flow increase following precipitation events, even the minor ones which characterized the spawning season. See **Appendix C** for a table of fish numbers organized by species, reach, and date.

Figure 3. Observation of Fall Chinook and steelhead during the 2015 Salmon River surveys.



No Coho were incidentally observed during the Fall Chinook surveys. However, an accidental hooking of a Coho by a steelhead fisher did occur on November 24th on the mainstem near Forks of Salmon. The fish was successfully released.

Salmon River tributary surveys occurred during early-November when turbidity levels on the North Fork made surveys impractical, and again at the end of the season. Chinook salmon redds and live Chinook were found only at Nordheimer Creek; and a single steelhead was reported in Little North Fork Salmon River.

Tributary Chinook and redd observations were restricted to Nordheimer Creek. Because of low flow conditions restricting entry to most creeks and/or rendering potential spawning sites unusable, only the four largest streams within the survey area were visited. It appeared only Nordheimer Creek was physically accessible to fish; and systems, such as Knownothing Creek and Methodist Creek, which usually show good activity were quiet. Normally, fall flows limit easy access to tributaries until November freshets increase discharge, corresponding to the latter portion of the fall-run. In 2015, the first major storm did not occur until early-December, after spawning was complete. Consequently, fish did not have the opportunity to use most tributaries.

Scott River

Based on the available data, the Scott River reached the peak of spawning in mid-October for Reach 1 through Reach 8 (**Figure 4**). The exact date is difficult to determine because, like the Salmon River, spawning was uncharacteristically constant through much of October. Normally, surveys in the Scott River capture a distinct spawning peak in mid- or late-October. This temporal adjustment is likely associated with the low discharge condition: fish may have initially been waiting for fall precipitation to assist with passage over low-water barriers (see next paragraph for further discussion), but when the freshets failed to materialize, female Chinook began to spawn at the point when a given individual could no longer “wait”. Overall survey effort was affected by number of surveyors available, weather, and flows. See **Appendix C** for a table of redd numbers organized by reach and date.

Distribution of spawning fish in the Scott River drainage was affected by extremely low discharge conditions which extended later into the season than normal. Typically, the majority of spawning in the survey area occurs in Reach 8; and even during “normal” low water years, fish can successfully ascend the river through challenging habitat. However, only a limited number of fish made it to Reach 8 this year, and those which did make it ultimately had upstream progress halted by a beaver dam. While CDFW will sometimes notch dams during low water to assist fish passage, this action was not undertaken in 2015 because of impassible dry channel conditions upstream. Lower in the drainage, the primary culprit restricting fish upmigration occurred in Reach 6 in the form of a rocky cascade which Chinook can normally navigate via jumping or otherwise making their way through the rocks (**Photo 1; Figure D-SC7**). Fish have been observed, even during a normal water year, having difficulty passing the obstacle, but the degree that it was a barrier at extremely low flows had not been realized fully. Because of this hurdle, and the lack of fall freshets to increase discharge enough to facilitate fish movement past it, Reach 6 ended up with a much greater percentage of the total redd amount than normal, and Reach 8 with a much decreased percentage. Similarly, other reaches, such as Reach 3 and Reach 5, also appear to have exhibited more redds than normal. See **Appendix D** for redd spatial distribution and density information.

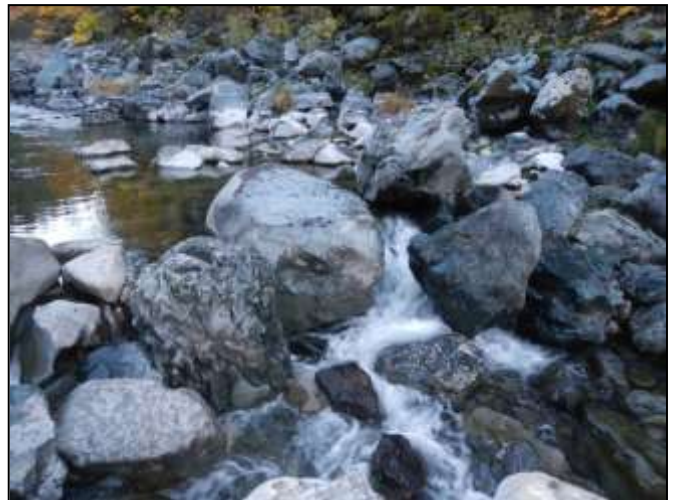
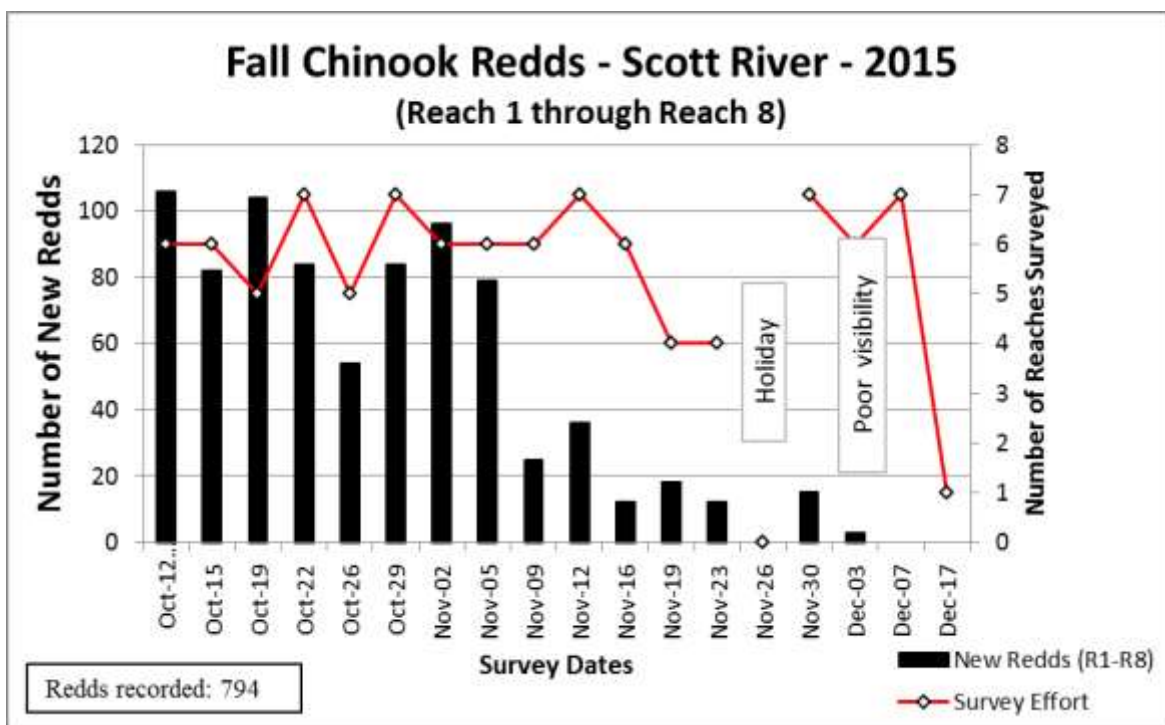


Photo 1. Low discharge barrier in Reach 6.
(Photo by M. Kneckle, CDFW)

Access to portions of Reach 2 and Reach 3 which traverse private property in the lower Scott River has been an issue most years since 2010. For 2014, all properties were walked and flagged. The only exception was Reach 3 within the riverfront viewscape of the Trabucco residence, where flags were not hung for several hundred feet. In this location, all redds were counted each time. The maximum number of unflagged redds observed during a single survey in Reach 3 was 12. Redds in the unflagged portions of this reach are not included in final map outputs.

Figure 4. Fall Chinook redds observed and survey effort on the Scott River in 2015. Due to differences in redd tracking between canyon and valley reaches, data displayed is for Reach 1 through Reach 8 only.



The Scott Valley Resource Conservation District (RCD) normally performs redd and carcass surveys upon private property from Reach 12 through Reach 16, as well as several Scott Valley tributaries. These surveys did not occur in 2015 because continuing drought conditions decreased flows sufficiently for the mainstem to disconnect multiple places in the valley. Surface connectivity did not re-establish until early-December storms and after most Chinook had completed spawning. A survey by CDFW through Reach 8 on December 17th confirmed a lack of end-of-season redds, even when river levels had risen sufficiently to allow fish passage over beaver dams.

Specific areas of the Scott River display a greater preference for use by spawning Fall Chinook. Five years of mapping redds by GPS (with hardcopy map back-ups) is revealing patterns. There are areas which show annual use at both high and low densities, as well as scattered redds which likely represent opportunistic use of habitat which may be locally limited in extent and/or only available under certain discharge conditions.

The GoogleEarth redd overlay will not be updated for 2015 due to drought conditions persisting through the spawning season and substantially altering use patterns as observed 2011 to 2014. Annual updating of the general dataset will continue in 2016, omitting the 2015 dataset as an outlier. Spawning seen in 2015 will be set aside for inclusion in a “low water distribution” map database, to be compiled at a future date. Acquisition of new data (under conditions which do not include exceptional drought) will better refine identified concentrated use areas, as well as define other sites with consistent, but lighter, use.

See the “Discussion” section for a discussion on changes in spawning use patterns during years of exceptional low water.

Focus for the dataset is upon locales which exhibit multiple years of use at moderate or greater density of redds. Defined the same as for the Salmon River, “concentrated use areas” are redd groups which, within at least two of the previous four years (not inclusive exceptional drought years), have possessed a minimum density of 6 redds within an approximate 100 meter linear distance.

- Scott River (Reach 1 through Reach 8 – ~24.5 miles)
 - 39 concentrated use areas
 - Notable sites (downstream to upstream) include Johnson Bar River Access; County Road 7F01 (Scott River Road) bridge above Johnson Bar; approximate river mile 2.9 (above Middle Lick Gulch); swimming hole just upstream of Scott Bar; Gold Flat River Access; Middle Creek vicinity; Indian Scotty Campground; and most sites in Reach 8.

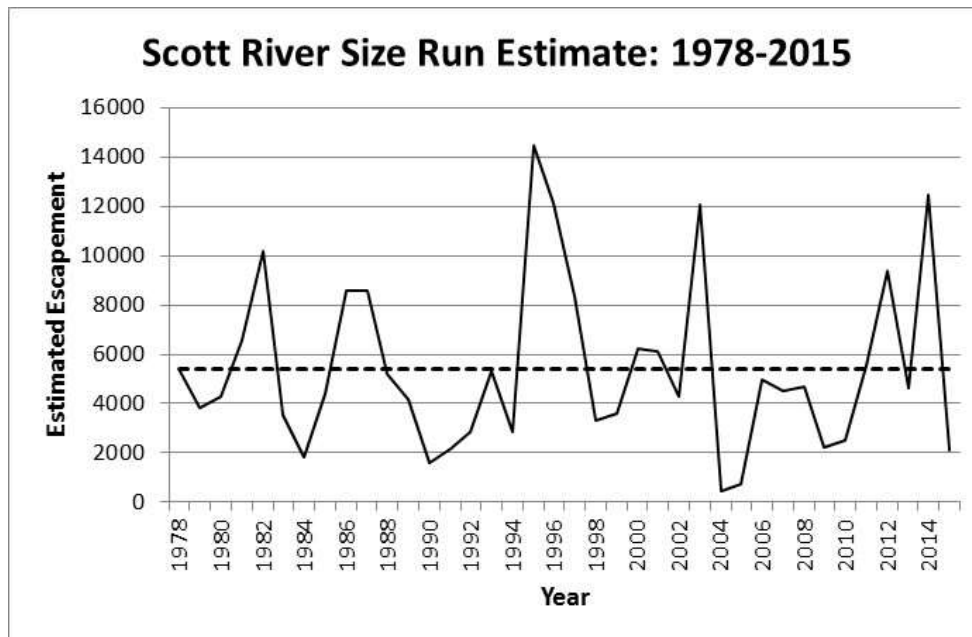
In 2015, fish distribution was broadly similar to previous years. However, there were notable differences with spawning at some concentrated use areas being lighter than years past, else spatially shifted upstream/downstream. The low water barrier in Reach 6 imparted a major impact in affecting moderate to high use areas. Most explicitly, there was no elevated use anywhere in Reach 8, both due to low numbers of fish which made it to this reach, as well as presence of beaver dams and dry channel.

Several locations were provisionally identified for inclusion to the concentrated use dataset, but another year of (non-drought) observation is required for confirmation.

- Scott Bar upstream/downstream of the bridge. Elevated use has been visually observed in the past, but 2015 was the first year with a season-long GPS dataset. (Surveys through town either did not occur or were sporadic 2011 to 2014).
- Two locations in the vicinity of private (Trabucco) property. In 2015, the private property, except within line-of-sight of the house, underwent comprehensive survey for the first time, including flagging of redds. Previous surveys in this segment of Reach 3 (2011 to 2014) either did not occur, were sporadic, and/or flagging was not set.
- Possible extension of concentrated use area at Schuler Gulch. Extension may represent an area which has greater spawning under conditions of lower discharge. Low discharge may be season-long (as in 2015), else earlier season prior to stormwater inputs.

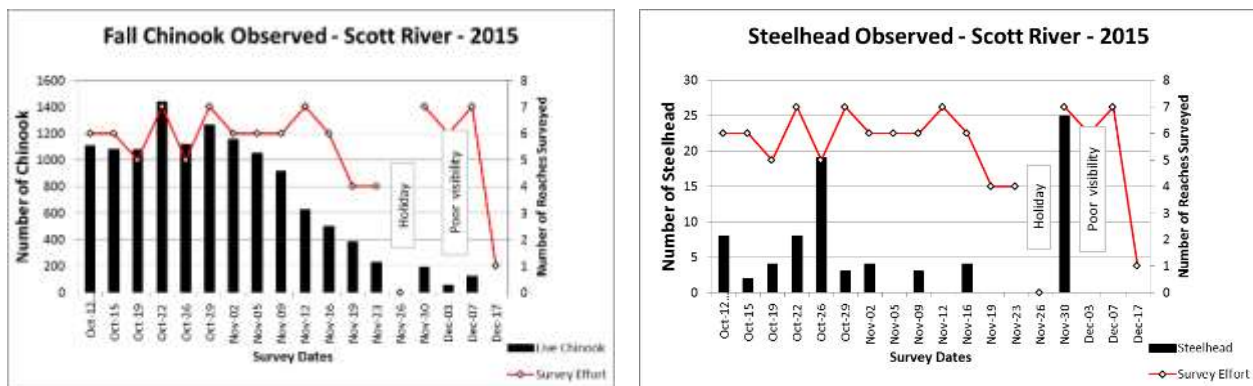
Using survey data and video weir observation, the Scott River is estimated to have had 2,113 Fall Chinook salmon return in 2015 (**Figure 5; Appendix A**). Based on long-term tracking data compiled by CDWF, 2015 was below average, ranking 34th (of 38 years) for run size.

Figure 5. Scott River fall-run size estimates for 1978 to 2015. Dashed line is average over long-term survey period.



Live Chinook and steelhead were tallied during surveys (**Figure 6**). As with redds, fish observation is affected by number of surveyors, weather, discharge conditions, and surveyor experience. Peak live Chinook was observed in the latter portion of October, with subsequent numbers declining throughout the survey area. Similar to the redd count, number of live Chinook appear to have remained fairly steady through much of October, before declining through November and into December. This observation likely reflects the extended time fish were holding, followed by spawning when fall precipitation did not arrive to facilitate passage over low water barriers. Overall, steelhead numbers were low, but they seemed to be reported with greater frequency in association with precipitation, even when those events minimally affected Scott River discharge. See **Appendix C** for a table of fish numbers organized by species, reach, and date.

Figure 6. Observation of Fall Chinook and steelhead during the 2015 Scott River surveys (all reaches).



Coho were incidentally observed during the Fall Chinook surveys:

- November 30th
 - Possible Coho amongst school of Chinook in Reach 1 (Confluence to Mid-Point)

Scott River tributary surveys for the canyon reaches occurred during November and December (**Appendix C**). Chinook redds and fish were seen in Kelsey Creek; and a single live fish in Canyon Creek.

DISCUSSION

Water discharge affected distribution of spawning fish in Scott River and Salmon River. Due to continuing drought, the Fall Chinook survey season began with water levels in both drainages very low compared to normal; and unlike the last several years, no fall storm event provided sufficient precipitation to notably boost flows while fish were actively spawning. See **Table 3** for a summary of discharge, storm timing, and run size since 2011. Because there was no end-of-season storm event, surveys ultimately ended due to lack of new redds, live fish, and carcasses.

Table 3. Summary of river discharge, storm timing, and Fall Chinook run size for Salmon River and Scott River for 2011 through 2015.

Year	Salmon River			Scott River		
	Discharge ¹	Storms ²	Run Size ³	Discharge	Storms	Run Size
2011	Normal	Early Late	Well above average	Normal	None	Average to above
2012	Normal	Mid-Late Late	Well above average	Low	Late	Well above average
2013	Normal to low	Early Late	Average to below	Very low to low	None	Below average
2014	Normal	Mid-Early Mid-Late Late	Above average	Low to normal	Mid-Early Late	Well above average
2015	Low to very low	None	Below average	Very low	None	Well below average

¹Discharge – defined using the same daily discharge percentile cut-offs as the USGS gage dataset (see Appendix B for gage locations). Only considered for the active survey period.

- Very low - majority of daily discharge is below 10th percentile of daily means
- Low - majority of daily discharge is between 10th and 25th percentile of daily means
- Normal - majority of daily discharge is between 25th and 75th percentile of daily means
- High - majority of daily discharge is between 75th and 90th percentile of daily means
- Very high - majority of daily discharge is above 90th percentile of daily means

If there is no definite top rank, then top two ranks are included, with first descriptor the majority rank

²Storms – fall freshet/storm timing defined as:

- None - no appreciable change in discharge (on gages) due to storms
- Early (before Oct 15)
- Middle-Early (Oct 15 to Oct 31)
- Middle-Late (Nov 1 to Nov 15)
- Late (after Nov 16)

³Run size – run size defined as:

- Average (to above/below) - within 10% of long-term average
- Above/below average - within 10% to 50% of long-term average
- Well above/below average - more than 50% deviation from long-term average

The effect of exceptionally low discharge upon Fall Chinook was best observed on the Scott River. While 2014 started as a low water year, October storms reconnected dry valley reaches and breached Reach 8 beaver dams, which ultimately allowed fall-run Chinook to not only occupy traditional spawning sites, but ascend to locales at the upper extent of their range which are rarely accessed. In contrast, there was no notable fall precipitation in 2015, and river levels remained low throughout the spawning season. As described prior, a rocky cascade in Reach 6 was the primary impediment to upstream fish movement. Although some fish did manage to pass

this obstacle, the upstream numbers as expressed as a percentage of the run were greatly reduced compared to usual (**Table 4**). Downstream of the barrier, fish which might have traveled to Reach 8, else further upstream into the Valley – the majority of Scott River fall-run Chinook spawn in these locales – were forced to utilize Reach 6. Consequently, this reach supported a much greater percentage of total redds than normal. Difficulty passing natural obstacles may also be a reason why other areas (e.g., Reaches 2, 3, and 5) also experienced elevated use. It is likewise possible low water exposed suitable spawning areas in different places while simultaneously making normal use locales unattractive due to shallow (or dry) conditions. Localized shifts in distribution were observed, with some areas of normal moderate or high use supporting very few fish; and fish were seen spawning in gravel/cobble microhabitats where normal hydrologic conditions would not be conducive for such activity. It should be stated that the apparent increase in usage in Reach 2 may be a survey artifact: 2015 is the first year (within the survey dataset of 2011 to 2015) to fully flag and GPS through the town of Scott Bar; and while a high use area has been visually observed upstream/downstream of the bridge for decades, its extent has not been fully documented using modern technology until this year. Another year or two of data is necessary to validate the Scott Bar concentrated use area and the overall effect to Reach 3 use percentages. Oddly, the 2015 below average run size may have benefitted Chinook: while drought-caused restriction of spawning habitat is not good, the results (i.e., later spawning fish partially or completely digging out the nests of earlier fish) might have been much worse had there been higher competition for limited resources.

Spawning surveys in 1994 recorded a year of exceptional low water in the Scott River drainage whereupon Jones Beach (in Reach 7) represented the upstream limit of fish access. While “low water” is not an unusual occurrence for at least a portion of the spawning season, years such as 1994 and 2015 likely represent a threshold whereupon the obstacles like the Reach 6 cascade become a major barrier impeding fish movement. While this particular obstruction appears to be hard to bypass during “normal” low flows, it doesn’t seem to truly block fish unless a certain discharge is reached and no appreciable fall precipitation occurs to create a passage window of opportunity. Given past history, the conclusion is that the restricted distribution observed in 2015, while rare, is not a new occurrence, and fish in subsequent years will reoccupy their normal range given adequate water.

Low water, combined with a lack of significant precipitation, also affected Fall Chinook fish distribution within the Salmon River drainage (**Table 4**). In general, it appears there was a reduction in use at the upper extents of the survey area. In the South Fork, Reach 6B experienced depressed use compared to usual; and crews also informally reported less fish in the upper portion of Reach 6A, even taking into account low run numbers. A prominent Reach 6A landmark between Indian Creek and Methodist Creek is a narrow bedrock canyon about 0.3 miles long where redds are not found. The canyon includes a stretch of high gradient boulder/bedrock cascade. It is possible that the low water reached a threshold whereupon the rapids became difficult for fish to traverse. Multiple obstacles functioning as partial low-water barriers cumulatively affecting fish distribution was likely a theme for both South Fork and North Fork. In the North Fork, there are no recognized barriers and upstream spawning activities naturally “peters out”, even during a normal water year, probably due to the collective presence of higher gradient rapids, boulder jumbles, and other small impediments throughout Reach 9B and Reach 10. In 2015, that attenuation seems to have occurred lower in the river, which subsequently affected the percentage of fish which ascended higher in the drainage. Of note, relatively few redds were observed in Reach 11 downstream of Little NF Salmon River (and the

single redd upstream of the confluence may have been of spring-run origin). In the mainstem, a greater percentage of the run spawned in Reach 4B, which also might be a symptom of fish reluctant to enter either South Fork or North Fork with their lower discharge. There is also the possibility, similar to Scott River, where low water created new spawning opportunities. Shifts in spawning to concentrate in locales that in previous years recorded minimal or no use was more evident throughout Reach 4, as compared to North Fork or South Fork reaches.

Table 4. Percentage of fall-run Chinook utilizing surveyed reaches 2011 through 2015. Numbers highlighted and bolded in 2015 indicate reaches where exceptionally low water, sans fall storms, may have affected spawning distribution.

Reach		Year				
		2011	2012	2013	2014	2015
<i>Scott River</i>						
	R1	10%	13%	17%	14%	14%
	R2	7%	12%	8%	7%	16%
	R3	4%	6%	10%	10%	16%
	R4	5%	6%	11%	7%	10%
	R5	5%	5%	7%	11%	15%
	R6	8%	7%	9%	13%	23%
	R7	9%	8%	4%	2%	3%
	R8	52%	43%	33%	37%	3%
<i>Salmon River</i>						
MS	R4A	8%	10%	7%	4%	13%
	R4B	11%	14%	11%	14%	21%
SF	R5A	12%	12%	9%	9%	13%
	R5B	13%	12%	12%	14%	11%
	R6A	10%	7%	17%	14%	7%
	R6B	7%	10%	9%	10%	5%
	R9A	11%	13%	12%	10%	14%
NF	R9B	8%	7%	6%	7%	8%
	R10A	5%	4%	4%	7%	1%
	R10B	7%	7%	8%	6%	4%
	R11A	5%	2%	4%	4%	2%
	R11B	3%	1%	1%	1%	0%

Salmon River tributaries experienced a clear impact due to low water. Specifically, neither Knownothing Creek, Methodist Creek, nor Little North Fork Salmon River recorded fish or redds in 2015. The mouth of many Salmon River tributaries within the survey area possess a steep, often cascading, approach through a delta which are observed to be difficult for fish to ascend during low water. This is particularly true for Methodist Creek and Little North Fork Salmon River. A comparison can be made between 2014 and 2015. Although 2014 began the season similar to 2015 in regards to very low water and inaccessible tributaries, October storms

arrived at the perfect mid-season time for fish to take advantage of the subsequent increase in discharge to move into tributaries in higher numbers than usual, and in some cases migrating further upstream than is customarily observed. Conversely, 2015 never included a sufficiently significant event that allowed fish to circumvent low-water confluence barriers, and, therefore, these streams were never utilized. In contrast, Nordheimer Creek, with its easily entered mouth, was used by spawning Fall Chinook despite low discharge conditions.

Of note, in the summer of 2015, landslides occurred in the North Fork subwatershed of Music/Highland Creek. These debris flows were the result of an intense thunderstorm stalling over landscape impacted by moderate- and high-burn severity from a 2014 wildfire. A large amount of fine sediment from the landslides made its way to North Fork Salmon River, where it impacted over 20 miles of river (and more, if the mainstem below the North Fork/South Fork confluence is considered). Mobilized fine sediment from a small amount of rain caused sufficient turbidity in the North Fork to cancel a survey day upon the fork, but it was not until after the conclusion of surveys did an event occur which was large enough to initiate movement of significant amounts of settled sediment from the system. Therefore, it is not unexpected that the presence of excess fines might have affected spawning Fall Chinook. Overall, there was less use of the North Fork than usual – 29% of the overall run, compared to 34% to 39% - but it is unclear if debris flow fines, drought-impacted access to spawning grounds, or a combination thereof is responsible.

Although specifics in regards to the Salmon River and Scott River drainages are unknown, it is anticipated that climate change will eventually have an effect on the region. Safeeq, *et al.* (2015) took historical winter data from the western United States to determine which regions were more sensitive to projected temperature increases and, hence, shifts in the projected proportion of precipitation falling as snow and/or rain. For the Klamath Mountains, they projected that by 2040, the average winter precipitation year will look more like what happens during current warm winters. In other words, the average snow line will be higher, there will be less snow at low elevations and less snow overall as more precipitation falls as rain. In turn, there will be hydrologic changes as a smaller, higher elevation snowpack translates to less spring run-off and less water in general through the remainder of the year. Winter temperatures will not only be affected, but temperatures throughout the year; and by the 2060s, what is now considered to be an exceptionally “hot” summer day will become much more common in California, as will be the occurrence of multiple sequential “hot” days (Pierce, *et al.* 2013). The effect of climate change upon timing and amount of precipitation is less clear. The most recent research on climate models for California suggest that average annual precipitation in the northern portion of the state will remain relatively constant (Pierce, *et al.* 2013). A slight increase in winter precipitation may be offset by less summer precipitation, but overall, precipitation patterns will likely remain within the range of historical natural variation, making it very difficult to resolve if climate change is having an effect of precipitation amount or timing (Pierce, *et al.* 2013).

The challenge of climate change will eventually affect fall-run Chinook. Current inter-annual variability, including recent past and near future, of factors such as river discharge and run-size are not necessarily attributable to climate change, but are likely instead within the variability of the natural cycle. However, observations of Chinook behavior and habitat use made during current cycles of dry, normal, and high water, as well as differences between above- and below-average run years, do provide a view of future expectations as the climate shifts. For instance, river discharge, in conjunction with the timing of fall storms, strongly influences access. The

underlying summer/fall baseflow is expected to be affected by climate change, with less winter snowpack and/or more frequent incidences of drought directly impacting how much water upmigrating Fall Chinook encounter when they enter the river. As low flow and exceptionally low flow conditions become more common, then a scenario similar to that observed in 2015 may also become more frequent; and those circumstances can be amplified in drainages like the Scott River which include large amounts of water withdrawal for irrigation and other purposes. On the other hand, at this time it appears climate change will minimally affect fall precipitation events, so their occurrence will remain within the range of past variation (i.e., sometimes they occur [2012, 2014] and sometime they do not [2015]). These events will become increasingly critical in permitting Fall Chinook to access traditionally utilized locations which may otherwise be difficult to reach. How future impacts from climate change will ultimately affect Fall Chinook distribution is a large question, one which requires a long-term dataset like that available from the Scott River and Salmon River, to address.

Survey Observations and Recommendations

The desired result for spawning (redd) surveys conducted in the Salmon River and Scott River watersheds is to create a dataset applicable in guiding locally informed management decisions (Forest Service and private individuals) in regards to projects, ongoing/proposed upland and riparian land use activities, and response to climate change. Products, such as the GoogleEarth overlay of redd concentrated use areas, are one result, and others are anticipated in the future.

Many issues and problems encountered each year during the Fall Chinook surveys are observed on an annual basis. Most concerns are of the type which are addressed by agency managers early, with individual crews or as a survey whole, and then not adequately followed up upon during the remainder of the spawning season. This laxity allows undesirable crew habits to re-emerge later in the season, else persist if not effectively corrected from the start. Additionally, other common problems may not be seen during cursory in-season QA/QC, only showing up when data is closely examined and compiled in the post-season.

To address common annually reoccurring issues, it is the responsibility of the agency survey manager, or their representative, to ensure crews fully understand all aspects of survey protocol. Although pre-season training introduces (or re-introduces) the protocol to crew, the information imparted may not be fully understood by a new crewmember, or yearly adjustments in protocol might not be wholly absorbed by a multi-season surveyor. Therefore, it is highly recommended that survey managers begin each survey day by reminding crew of the expected protocol. This activity should occur prior to acquisition of datasheet/map packets, before crews have begun to scatter to their assigned reach and it is much more difficult to capture the group attention. This daily announcement may include proper dictation of carcass and/or redd numbers, GPS protocols, reminder to fill in summary sheets, and any other issue of concern. Where reaches have special instructions, like flag/no-flag segments or no-access private property areas, conversation should also be undertaken with individual crews.

Communication between KNF and CDFW survey managers is paramount. In addition to attending the normal pre-season multi-agency meeting, survey managers for Salmon River and Scott River should communicate with each other prior to the survey season. The goal is to exchange recommendations on how to better administer the upcoming spawning surveys, which may include suggestions for minor changes in datasheets, protocol, and so forth. Furthermore, and of particular importance during the survey season, managers which observe the emergence

or persistence of an issue during their survey day should convey such to other manager(s) to ensure the problem is specifically and immediately addressed the next survey day, not the following week, or later.

The morning rush by surveyors to leave for assigned reaches means not all datasheets/maps may be gathered, even with repeated verbal reminders. Survey fatigue also begins to set in during November. As a consequence, there are times when not all datasheets/maps are turned in, leading to missing data; and data quality starts to slip by the end of the season compared to the beginning. Over the last several years gains have been made in respect to returning all datasheets, but problems persist.

- Recommendation is to continue to provide data packets (carcass sheets, redd sheets, maps) to each crew individually. This procedure should occur on both the Salmon River and the Scott River. Packets may be handed out personally by the survey administrators, else via a delegated individual. During the free-for-all morning gathering of datasheets/maps, there are inevitably crews who forget something. Additionally, this point of interaction is a good time to provide reminders to individuals and/or crew as to protocol or reach-specific instructions.

Commonly observed crew-associated issues for agency managers to address during training and the daily survey announcements:

- Correctly fill out all datasheets.
 - Complete header information as appropriate – start/end time, weather, streamflow, temperature (when available), crew names, etc. Header information allows survey administrators to gage effort. For instance, it is expected that better data will have been gathered in conditions of clear water and sunny skies, compared to rain/wind with high flows.
 - For redds, always use the header sheet. Only use the continuation sheet as the primary datasheet for redds when no header sheet is available.
 - Count all live fish. Record total live Chinook seen during a survey on both the carcass and redd datasheets. The redd sheet also asks for Coho and steelhead. If there are no fish, write a “0”. This action confirms to the administrator that a count was undertaken.
 - “Live fish” on the summary sheet is Chinook only (includes jacks and adults). If other species are to be reported, they should be written in the comment section.
 - Redd dimensions should be measured to the nearest 0.1 meter, or as close as possible given equipment limitations. **Do not** use feet. **Do not** use the nearest meter or half meter. **Do not** assume all redds are the same size and thereby report the same dimensions repeatedly.
 - “Unflagged Segments” on the redd sheet should only be filled in when and where not flagged. This may be an entire reach (i.e., Reach 5A, Salmon River) or a partial reach (i.e., Reach 3, Scott River). For reaches which are only partially flagged, the final redd count will be split into two components: measured redds and count-only (not-measured) redds.
 - Always fill out the hardcopy maps! They are used for post-season QA/QC, as well as a back-up should GPS data be lost or not collected.

- Perform the GPS protocol correctly.
 - Each redd is a single GPS point – do not lump multiple redds into a single point. GPS points are used to delineate location of spawning areas for management and monitoring purposes. Mapping resolution for GIS or GoogleEarth is lost when redds are grouped.
 - Input the correct redd number label.
 - When a crew is GPSing, they should capture **all flags** which have not already been mapped, not just the new ones recorded that survey day. Do not assume that a redd has already been GPSed - check flagging for knots.
 - Use information on flagging – date and redd number – to build a redd GPS point. Do not sequentially number all redds on the day that the GPS is used, regardless of original date of discovery.
- Other issues
 - At the end of the survey day, turn in all datasheets and maps, even those with negative information; and completely fill out the summary sheet, ensuring information is entered on the correct date.
 - Where reaches are split into “A” and “B”, survey administrators need to ensure crews are aware of which subreach is being surveyed. Subreaches primarily occur on the Salmon River, although, depending upon fish numbers, they may also be used part of the season for Reach 8 of the Scott River.
 - If a reach is ended early due to injury, weather, or other reason, mark on the map where the survey stopped.
 - Redd flagging should always include survey date and redd number to avoid double-counting.
 - To avoid multiple measurements of the same redd within “Unflagged Segments”, as well as maintain survey speed, there is no need to take redd dimensions within these areas. Mapping and/or GPSing should still occur, as directed by the survey administrator.
 - Ensure crews know any “special instructions” for a reach, such as flag/no-flag segments and entry/exits to avoid private property.
 - Where there are “special instruction” areas that are skipped for part of the season (e.g., Salmon River, Reach 9A, at Pollocks Gulch by request of adjacent landowner), be sure that redds are recorded and GPSed prior to end of the season.

The 2015 Fall Chinook survey almost met the desired goal, as stated in prior reports, for sufficient equipment be available to allow all reaches to be GPSed for redds every survey. KNF and both CDFW offices were able to commit sufficient GPSes to cover their own crews, as well as often possessing an extra machine for use by non-agency crews. Additionally, most tribal crews, watershed councils, and other entities now possess their own GPS units. While there were occasional issues in regards to batteries or malfunctioning (or misplaced) equipment, spare units allowed for near universal coverage. Furthermore, the KNF survey administrator devised a better system, compared to 2014, to track weekly gathered GPS files and ensure better coverage and capturing of data gaps. This system will be updated for the 2016 spawning season. It is strongly recommended that all agencies/entities continue to commit to bringing at least one GPS-per-crew to every survey.

Continuing, there are several recommendations aimed specifically at KNF and CDFW, as based upon survey observations made in 2015, as well as prior years:

- The KNF administrator should continue to ensure that redd datasheets and maps are always available, thereby eliminating the need for crews to improvise.
- Update redd sheets to include an example of the redd GPS point.
- Consider the possibility of placing a map on the back side of the header redd datasheet.
- The “Unflagged Segment” of the redd datasheet should be revisited by KNF to determine if there is a modification which will make it more clear to crews as to where and when this section should be filled in.
- The Forest Service should continue incorporation of several GPS-centric items into the annual pre-season survey training “Redd Station”, including -
 - How to title redd GPS points.
 - Presentation of a visual on how multiple years of GPS data have led to delineation of spawning concentration areas.
 - Visual comparison of accuracy of GPSing versus potential inaccuracy of hardcopy maps: even the best map reader can be several hundred feet off, which in turn will affect precision of the map product produced for management and monitoring purposes.
 - Emphasize importance of hardcopy maps as a back-up to GPS data, using the 2014 incident of KNF losing a GPS as an example.
- Pre-season training at all data collection stations should emphasize personal (crew) QA/QC prior to turning in datasheets, including correct header information and numbering for redds, carcasses, and scale/tissue envelopes.
- As necessary, flagging should be placed on the river and the road to demark entry/exit points to reaches, private property, flagged/unflagged segments, and so forth.
- Coordination with CDFW to investigate the possibility of minor modifications to daily summary sheets.
 - Expand the “Live Fish” field to specify “Live Fish – Chinook”, “Live Fish – Steelhead”, and “Live Fish – Coho”. Alternately, “Live Fish” is altered to ensure surveyors understand it is Chinook only.
 - Include a checkbox with each reach for the survey manager to mark when a reach is not surveyed. The manager should also comment why the reach was omitted (e.g., high water, insufficient crew, safety concerns).

Since 2011, there have been multiple successes in achieving higher quality and more consistent data:

- Protocol consistency between Salmon River and Scott River watersheds (on Salmon-Scott Rivers Ranger District).
- When datasheet/map packets are handed out by a survey administer or representative to crews, it is more likely that everything will be returned at the end of the day.
- Overall, crews are more likely to turn in the entirety of the datasheet/map packets, even when no redds, fish, and/or carcasses are found. It is better understood that a negative result is still valid information, whereas “missing data” is the same as if the survey was never completed.
- The CDFW summary sheets were altered to provide separate entries for “A” and “B” subreaches, as appropriate. This change eliminated the need for crews to manually draw a divider under the reach number and increased the likelihood that data was reported in the correct location.

- KNF more often checks on-site stock of maps and redd datasheets to ensure sufficient supplies are available for survey use.
- Evolution of GPSing, such as incorporation of knotting flags to show that mapping has already occurred.
- More GPSes are available to map redds. Between KNF, CDFW, watershed councils, tribal crews, and other entities, there is often sufficient equipment to GPS every reach at least once a week for both Salmon River and Scott River drainages.
- More regular downloading of GPSes. The KNF administrator brings a computer once a week to surveys to capture GPS data and tracks the downloaded data files.

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Appendix A – California Department Fish and Wildlife “MegaTable”

Due to large size of the Klamath River Fall Chinook Salmon Spawner Escapement, In-river Harvest and Run-size Estimates, only the most recent years and summary tables are provided in this Forest Service document. See the original California Department of Fish and Wildlife document for the full MegaTable, including footnotes and acronyms. At the time of this report, data for 2015 had been compiled, but not yet available in MegaTable format.

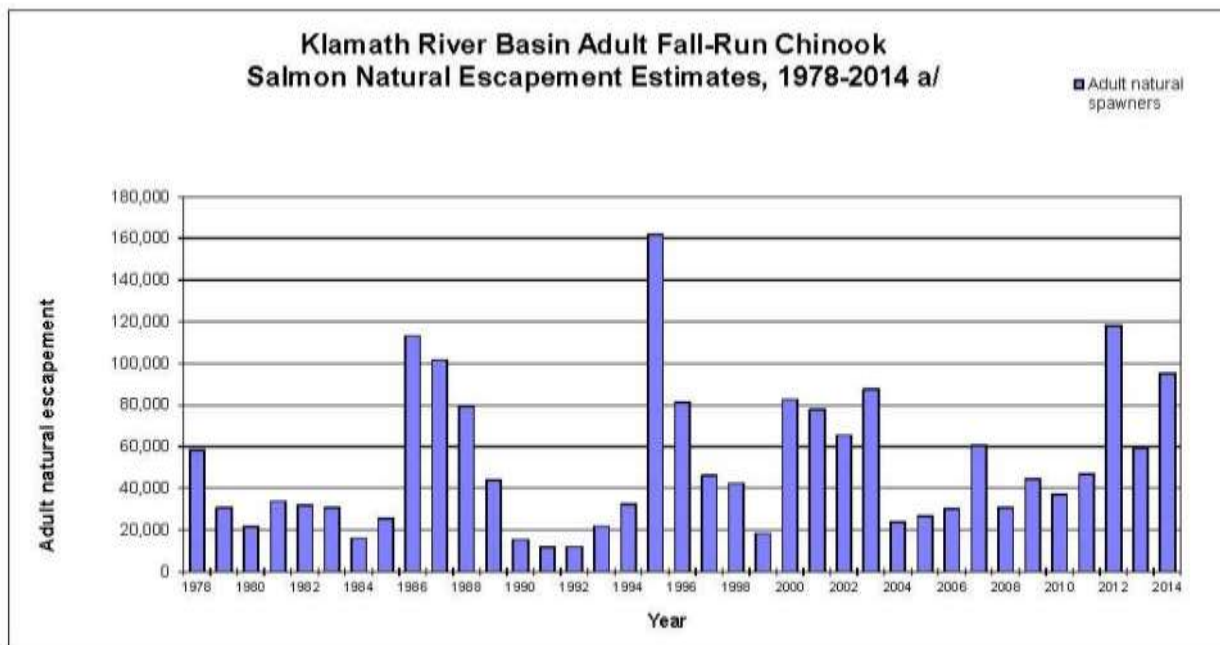
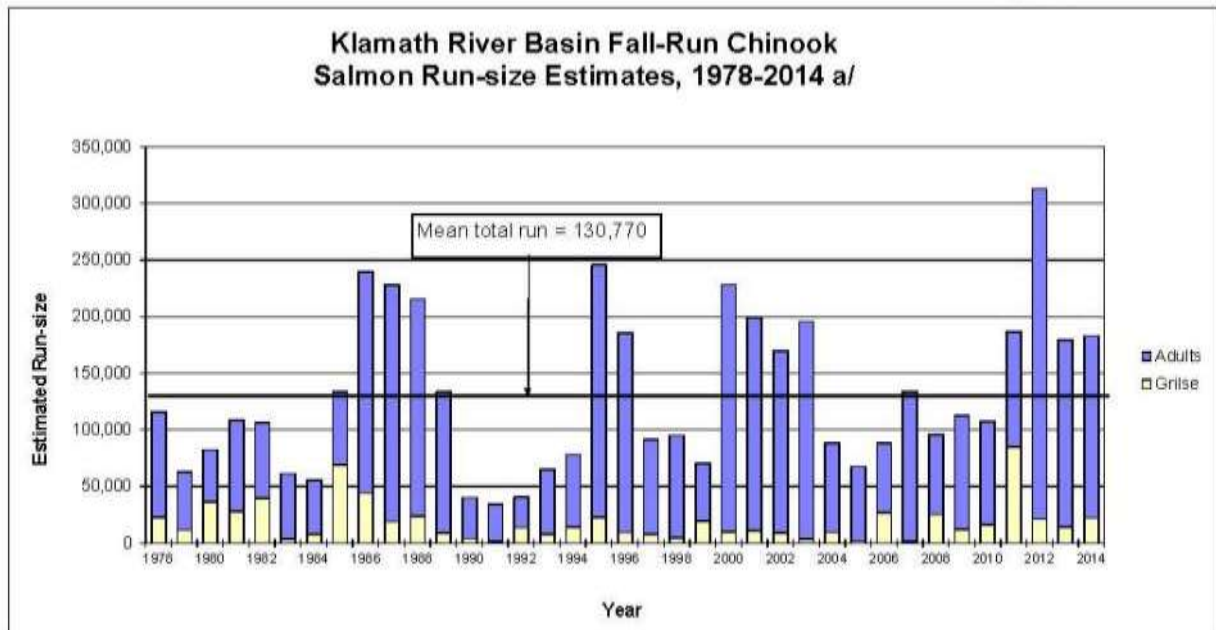
Klamath River Basin Fall Chinook Salmon Spawner Escapement, In-river Harvest and Run-size Estimates,
1978-2014 a/

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SPAWNER ESCAPEMENT									
	2011			2012			2013		
	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Hatchery Spawners									
Iron Gate Hatchery (IGH)	9,549	8,490	18,039	1,537	38,478	40,015	1,323	13,431	14,754
Trinity River Hatchery (TRH)	1,875	13,847	15,722	92	17,461	17,553	135	3,717	3,852
Hatchery Spawner Subtotals:	11,424	22,337	33,761	1,629	55,939	57,568	1,458	17,148	18,606
Natural Spawners									
Main Stem Klamath River n/									
(excluding 2010)	3,270	3,933	7,203	1,501	14,802	16,303	683	12,192	12,875
Salmon River basin	1,819	3,674	5,493	829	3,561	4,390	240	2,240	2,480
Scott River basin	2,502	3,019	5,521	1,783	7,570	9,353	588	4,036	4,624
Shasta River basin	11,175	213	11,388	1,944	27,600	29,544	1,096	6,925	8,021
Bogus Creek basin	2,303	2,919	5,222	839	11,792	12,631	338	3,682	4,020
Misc. Klamath tributaries o/ii/									
(above Yurok Reservation)	3,259	3,072	6,331	629	3,254	3,883	200	2,310	2,510
Yurok Reservation tribs. (Klamath River) p/	418	1,143	1,561	406	761	1,167	129	326	455
Klamath Natural Spawner Subtotals:	24,746	17,973	42,719	7,931	69,340	77,271	3,274	31,711	34,985
Main Stem Trinity River dd/									
(excluding 2010)	36,913	27,718	64,631	7,254	47,873	55,127	6,954	27,127	34,081
Misc. Trinity tributaries o/									
(above Hoopa Reservation)	96	542	638	79	520	599	20	78	98
Hoopa Reservation tribs. (Trinity River) p/	94	530	624	48	316	364	62	240	302
Trinity Natural Spawner Subtotals:	37,103	28,790	65,893	7,381	48,709	56,090	7,036	27,445	34,481
Natural Spawner Subtotals:	61,849	46,763	108,612	15,312	118,049	133,361	10,310	59,156	69,466
Total Spawner Escapement	73,273	69,100	142,373	16,941	173,988	190,929	11,768	76,304	88,072
IN-RIVER HARVEST									
	2011			2012			2013		
	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Angler Harvest									
Klamath River (below Hwy 101 bridge)	700	624	1,324	382	2,696	3,078	546	11,272	11,818
Klamath River (Hwy 101 to Weitchpec)	6,557	912	7,469	3,183	5,174	8,357	1,135	1,113	2,248
Klamath River (Weitchpec to IGH)	1,481	1,483	2,964	237	3,967	4,204	531	6,243	6,774
Trinity River basin	1,243	1,128	2,371	55	2,088	2,143	48	1,172	1,220
Angler Harvest Subtotals:	9,981	4,147	14,128	3,857	13,925	17,782	2,260	19,800	22,060
Tribal Harvest e/									
Klamath River (below Hwy 101 bridge)	429	17,218	17,647	68	87,747	87,815	205	57,504	57,709
Klamath River (Hwy 101 to Trinity mouth)	467	4,272	4,739	54	3,494	3,548	38	2,513	2,551
Trinity River (Hoopa Reservation)	426	4,863	5,289	55	4,145	4,200	16	3,019	3,035
Tribal Harvest Subtotals:	1,322	26,353	27,675	177	95,386	95,563	259	63,036	63,295
Total In-river Harvest	11,303	30,500	41,803	4,034	109,311	113,345	2,519	82,836	85,355
IN-RIVER RUN									
	2011			2012			2013		
	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Totals									
In-river Harvest and Escapement	84,576	99,600	184,176	20,975	283,299	304,274	14,287	159,140	173,427
Angling Mortality (2.04% of harvest) f/	204	85	288	79	284	363	46	404	450
Net Mortality (8.70% of harvest) f/	115	2,292	2,407	15	8,294	8,310	23	5,481	5,504
Total In-river Run	84,895	101,977	186,872	21,069	291,877	312,946	14,356	165,025	179,381

(continued next page)

SPAWNER ESCAPEMENT									
	2014			2015			2016		
	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Hatchery Spawners									
Iron Gate Hatchery (IGH)	1,039	24,300	25,339						
Trinity River Hatchery (TRH)	221	6,975	7,196						
Hatchery Spawner Subtotals:	1,260	31,275	32,535	0	0	0	0	0	0
Natural Spawners									
Main Stem Klamath River n/ (excluding IGH)	1,844	22,443	24,287						
Salmon River basin	527	2,706	3,233						
Scott River basin	2,051	10,419	12,470						
Shasta River basin	3,945	14,412	18,357						
Bogus Creek basin	323	12,607	12,930						
Misc. Klamath tributaries o/ (above Yurok Reservation)	1,498	6,877	8,375						
Yurok Reservation tribs. (Klamath River) p/	332	1,245	1,577						
Klamath Natural Spawner Subtotals:	10,520	70,709	81,229	0	0	0	0	0	0
Main Stem Trinity River dd/ (excluding TRH)	6,650	23,538	30,188						
Misc. Trinity tributaries o/ (above Hoopa Reservation)	47	515	562						
Hoopa Reservation tribs. (Trinity River) p/	52	568	620						
Trinity Natural Spawner Subtotals:	6,749	24,621	31,370	0	0	0	0	0	0
Natural Spawner Subtotals:	17,269	95,330	112,599	0	0	0	0	0	0
Total Spawner Escapement	18,529	126,605	145,134	0	0	0	0	0	0
IN-RIVER HARVEST									
	2014			2015			2016		
	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Angler Harvest									
Klamath River (below Hwy 101 bridge)	268	1,093	1,361						
Klamath River (Hwy 101 to Weitchpec)	2,847	1,875	4,722						
Klamath River (Weitchpec to IGH)	75	1,496	1,571						
Trinity River basin	171	813	984						
Angler Harvest Subtotals:	3,361	5,277	8,638	0	0	0	0	0	0
Tribal Harvest e/									
Klamath River (below Hwy 101 bridge)	153	20,039	20,192						
Klamath River (Hwy 101 to Trinity mouth)	130	3,434	3,564						
Trinity River (Hoopa Reservation)	65	2,439	2,504						
Tribal Harvest Subtotals:	348	25,912	26,260	0	0	0	0	0	0
Total In-river Harvest	3,709	31,189	34,898	0	0	0	0	0	0
IN-RIVER RUN									
	2014			2015			2016		
	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Totals									
In-river Harvest and Escapement	22,238	157,794	180,032	0	0	0	0	0	0
Angling Mortality (2.04% of harvest) f/	69	108	176	0	0	0	0	0	0
Net Mortality (8.70% of harvest) f/	30	2,253	2,283	0	0	0	0	0	0
Klamath River disease testing j/	11	288	299						
Total In-river Run	22,348	160,444	182,792	0	0	0	0	0	0



a/ 2014 data preliminary

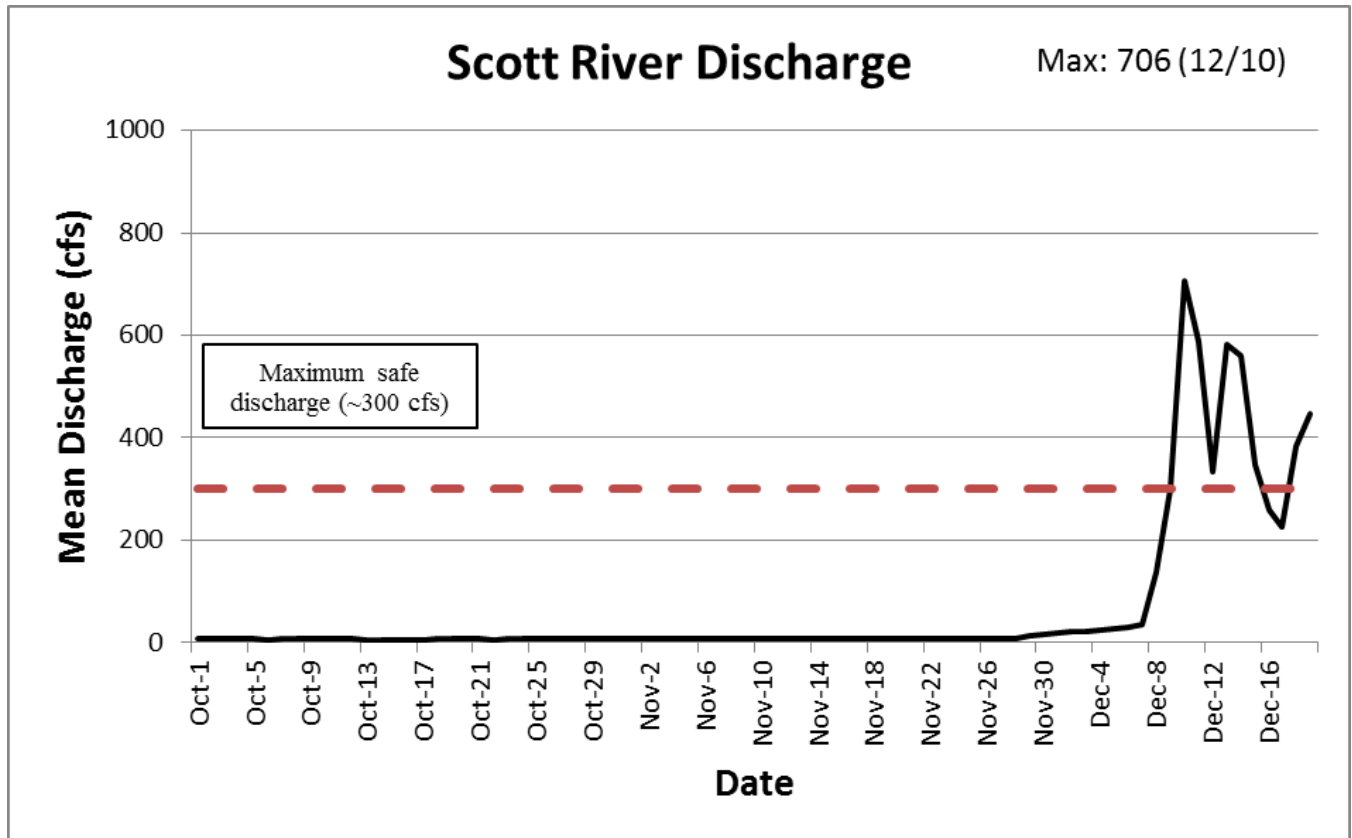
Appendix B – USGS Discharge Charts

Scott River

The Scott River gauge (11519500) is located 10.8 miles downstream from Fort Jones, CA.

- Legal location T.44N., R.10W., Sec. 29 (Mount Diablo Meridian); or
- Lat. 41°38'27" by Long. 123°00'50" (referenced NAD 1927)

The graph shown provides a daily mean of discharge at the gauge and includes October 1st through December 19th, 2015, which encompasses the redd/carcass survey dates and is inclusive effort by CDFW and/or other cooperators which may have continued after KNF had ended the survey season. Instantaneous discharges measured at the gauge can be higher or lower than that pictured. Variability in flow during an actual survey day may have provided a window of safe discharge not reflected in the figure.

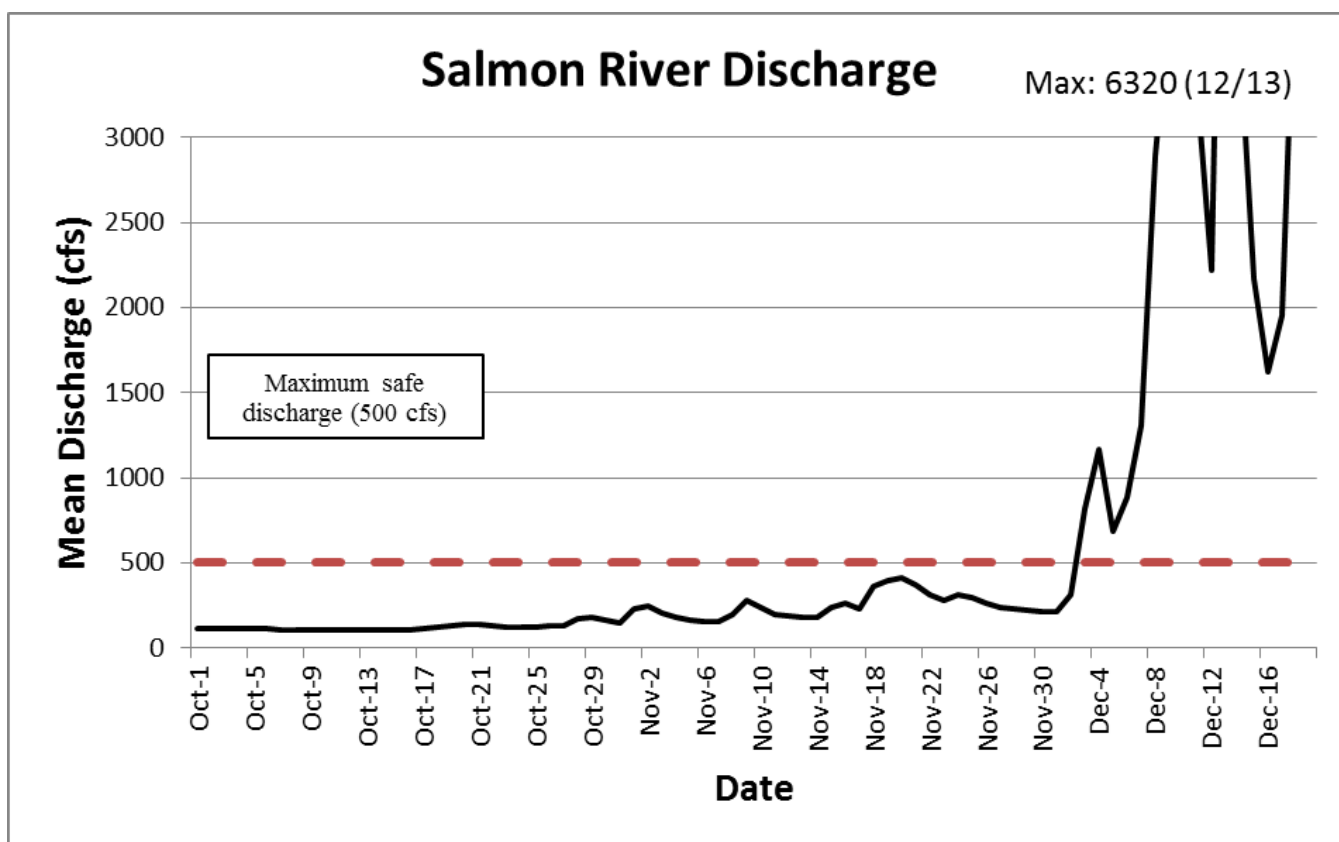


Salmon River

The Salmon River gauge (11522500) is located 1.0 miles upstream from Somes Bar, CA, at the confluence with the Klamath River.

- Legal location T.11N., R.6E., Sec. 3 (Humboldt Meridian); or
- Lat. 41°22'36" by Long. 123°28'33" (referenced NAD 1927)

The graph shown provides a daily mean of discharge at the gauge and includes October 1st through December 19th, 2015, , which encompasses the redd/carcass survey dates and is inclusive effort by CDFW and/or other cooperators which may have continued after KNF had ended the survey season. Instantaneous discharges measured at the gauge can be higher or lower than that pictured. Variability in flow during an actual survey day may have provided a window of safe discharge not reflected in the figure.



Appendix C – Redd and Fish Survey Tables (2015)

Salmon River Redds

Reach	Date														
	Oct-13	Oct-16	Oct-20	Oct-23	Oct-27	Oct-30	Nov-03	Nov-06	Nov-10	Nov-13	Nov-17	Nov-20	Nov-24	Nov-27	Dec-01
Mainstem															
4A - Otter Bar to Nordheimer Ck	18	7	3	13	4	34	3	1		0	1	0	nd	---	cs
4B - Forks to Otter Bar	56	11	22	4	3	9	7	0	17	2	0	0			cs
North Fork															
9A - Mile 2 to Forks	30	15	18	4	3	0		0	5	7	0	0	0	Holiday	
9B - Mile 4 to Mile 2	5	9	5	8	3	14		0	0	6	2	0	0		
10A - Mile 6 to Mile 4	3	0		0	0	1		2	0	0	0				0
10B - Mile 8 to Mile 6	14	3		4	6	0			0	0					0
11A - Mile 10 to Mile 8			10	0	0				0			0			
11B - Mile 12 to Mile 10			2									0			
South Fork															
5A - Henry Bell to Forks ¹	(9)	(30)	(0)	(84)	(65)	(49)	(34)	(29)	(27)	(43)	(62)	(63)		Holiday	(50)
5B - O'Farrill Gulch to Henry Bell	30	10	8	0	13	3	2	0	1	0	0	0	0		
6A - Indian Ck to O'Farrill Gulch	31		5	1	1	1	1	2	0	0	3	2	0		
6B - Matthews Ck to Indian Ck	13	6	2	1	2	1	4	4	1	0	1		0		

¹Reach 5A is not flagged - total number of redds counted each survey

*Underline = days which included pulling flagging. Carcass surveys ("cs") may be conducted after this date, but redds are not recorded.

*nd = no data (surveys performed, but datasheets or data missing; number likely 0)

Salmon River Tributary Surveys

Tributary	Date	Redds	Chinook	Steelhead
Knownothing Creek	Nov-03	0	0	0
	Dec-01	0	0	0
Little NF Salmon River	Nov-03	0	0	1
Methodist Creek	Nov-03	0	0	0
	Dec-01	0	0	0
Nordheimer Creek	Nov-03	15	8	0
	Nov-20	2	0	0

Salmon River (Live) Chinook Observation

Reach	Date														
	Oct-13	Oct-16	Oct-20	Oct-23	Oct-27	Oct-30	Nov-03	Nov-06	Nov-10	Nov-13	Nov-17	Nov-20	Nov-24	Nov-27	Dec-01
Mainstem															
4A - Otter Bar to Nordheimer Ck	75	26	22	10	28	37	16	10		6	2	1	nd	----	4
4B - Forks to Otter Bar	132	25	134	67	41	60	17	7	17	8	1	0			
North Fork															
9A - Mile 2 to Forks	32	133	60	51	33	20		3	8	9	8	0	0	Holiday	
9B - Mile 4 to Mile 2	6	17	13	61	12	5		2	0	1	2	0	0		
10A - Mile 6 to Mile 4	1	0		0	1	2		nd	0	0	0				0
10B - Mile 8 to Mile 6	5	6		2	4	3			0	3					0
11A - Mile 10 to Mile 8			7	1	2				0			0			
11B - Mile 12 to Mile 10			0									0			
South Fork															
5A - Henry Bell to Forks	72	51	65	32	21	18	6	4	1	3	4	7		----	1
5B - O'Farrill Gulch to Henry Bell	26	29	19	27	25	13	8	5	0	0	0	0	0		
6A - Indian Ck to O'Farrill Gulch	49		22	27	12	10	11	6	5	3	16	5	1		
6B - Matthews Ck to Indian Ck	17	12	20	8	7	2	2	0	6	2	0		1		

*nd = no data (surveys performed, but datasheets or data missing; number likely 0)

Salmon River (Live) Steelhead Observation

Reach	Date														
	Oct-13	Oct-16	Oct-20	Oct-23	Oct-27	Oct-30	Nov-03	Nov-06	Nov-10	Nov-13	Nov-17	Nov-20	Nov-24	Nov-27	Dec-01
Mainstem															
4A - Otter Bar to Nordheimer Ck	0	nd	0	0	0	12	8	17		nd	0	0	nd	----	62
4B - Forks to Otter Bar	0	0	1	1	0	0	0	2	0	1	nd	1			
North Fork															
9A - Mile 2 to Forks	nd	nd	0	nd	1	0		nd	0	0	0	0	0	Holiday	
9B - Mile 4 to Mile 2	nd	nd	0	0	0	nd		0	0	nd	0	0	0		
10A - Mile 6 to Mile 4	0	1		2	nd	nd		nd	0	0	0				0
10B - Mile 8 to Mile 6	0	nd		0	nd	0			0	1					0
11A - Mile 10 to Mile 8			nd	nd	0				0			nd			
11B - Mile 12 to Mile 10			0									nd			
South Fork															
5A - Henry Bell to Forks	nd	1	nd	0	0	4	0	7	0	0	38	3		----	13
5B - O'Farrill Gulch to Henry Bell	0	nd	nd	0	0	nd	0	0	0	0	0	2	0		
6A - Indian Ck to O'Farrill Gulch	nd		0	0	nd	nd	0	0	0	nd	0	8	nd		
6B - Matthews Ck to Indian Ck	1	nd	0	0	nd	nd	0	0	1	nd	0		0		

*nd = no data (surveys performed, but datasheets or data missing; number likely 0)

Scott River Redds

Reach	Date																	
	Oct-12	Oct-15	Oct-19	Oct-22	Oct-26	Oct-29	Nov-02	Nov-05	Nov-09	Nov-12	Nov-16	Nov-19	Nov-23	Nov-26	Nov-30	Dec-03	Dec-07	Dec-17
R1 - Midpoint to Confluence	33	6	20	7	9	16	1	17	0	0	0	0	0	Holiday	0	0	<u>0</u>	.
R2 - "Cabin Hole" to Midpoint	26	11	17	32	10	15	6	3	8		0				0	0	<u>0</u>	
R3 - George Allen to "Cabin Hole" ¹	32	15	27	1	14	5	16	9	3	0	3	2			0	0	<u>0</u>	
R4 - Townsend Gulch to George Allen	15	11	19	5	4	10	6		3	0	4		0		2		<u>0</u>	
R5 - Bridge Flat to Townsend Gulch	0	35	21	9	12	8	12	1	6	7	4	2	0		0	0	<u>0</u>	
R6 - CDFG Weir to Bridge Flat	0	4		22		27	54	31	5	13	0	14	12		1	0	<u>0</u>	
R7 - USGS Gauge to CDFG Weir				8		3		9		3						3	<u>0</u>	
R8 - Blw Meamber Bridge to USGS Gauge										13					12			<u>0</u>
R12 - Sweezy to Eller Lane ²																		
R13 - Horn Lane to Sweezy ²																		
R14 - Youngs Dam to Horn Lane ²																		
R15 - Fay Lane to Youngs Dam ²																		
R16 - Callahan to Fay Lane ²																		

*nd = no data (surveys performed, but redd count not reported) / Underline = days which included pulling flagging

¹Reach 3 - Does not include redds counted in front of house on private property (Trubucco)

²Due to drought conditions, valley reaches did not reconnect to lower mainstem until after Fall Chinook spawning - therefore, no surveys were conducted

*Note: surveys included unflagged sections of Reach 3; and the redd count from this location is not included in the above table. The Reach 2 maximum number of unflagged redds was 12. This redd count is reported separately in the document (Table 2) and not included in the compounded redd number (Figure 4).

Scott River Tributary Surveys

Scott Canyon (Agency-Cooperative)

Tributary	Date	Redds	Chinook	Steelhead
Canyon Creek	Nov-05	0	1	0
	Dec-15	0	0	0
Kelsey Creek	Nov-05	11	13	0
	Dec-15	0	0	0
Tompkins Creek	Dec-15	0	0	0

Scott Valley (Scott Valley Resource Conservation District)

None completed in 2015 due to drought conditions – fish had no access to tributaries.

Scott River (Live) Chinook Observations

Reach	Date																	
	Oct-12	Oct-15	Oct-19	Oct-22	Oct-26	Oct-29	Nov-02	Nov-05	Nov-09	Nov-12	Nov-16	Nov-19	Nov-23	Nov-26	Nov-30	Dec-03	Dec-07	Dec-17
R1 - Midpoint to Confluence	224	337	213	220	269	259	113	161	78	82	173	47	17	Holiday	72	0	3	-
R2 - "Cabin Hole" to Midpoint	349	226	194	251	242	134	126	43	65		19				7	3	2	
R3 - George Allen to "Cabin Hole"	268	257	250	193	310	288	155	128	93	75	102	51			2	0	4	
R4 - Townsend Gulch to George Allen	45	60	119	84	68	114	133		97	40	30		26		14		6	
R5 - Bridge Flat to Townsend Gulch	163	158	298	262	222	126	119	130	77	72	69	52	46		41	4	20	
R6 - CDFG Weir to Bridge Flat	56	42		382		322	505 ¹	562	504	318	104	231	136		55	47 ¹	87	
R7 - USGS Gauge to CDFG Weir				46		19		24		7						0	1	
R8 - Blw Meamber Bridge to USGS Gauge										28					1			0
R12 - Sweezy to Eller Lane ²																		
R13 - Horn Lane to Sweezy ²																		
R14 - Youngs Dam to Horn Lane ²																		
R15 - Fay Lane to Youngs Dam ²																		
R16 - Callahan to Fay Lane ²																		

*nd = no data (surveys performed, but Chinook count not reported)

¹Reach 6 completed over several days; therefore, some fish may have been counted twice

²Due to drought conditions, valley reaches did not reconnect to lower mainstem until after Fall Chinook spawning - therefore, no surveys were conducted

Scott River (Live) Steelhead Observations

Reach	Date																		
	Oct-12	Oct-15	Oct-19	Oct-22	Oct-26	Oct-29	Nov-02	Nov-05	Nov-09	Nov-12	Nov-16	Nov-19	Nov-23	Nov-26	Nov-30	Dec-03	Dec-07	Dec-17	
R1 - Midpoint to Confluence	3	0	nd	0	19	0	0	0	3	0	nd	0	0	Holiday	25	0	0	-	
R2 - "Cabin Hole" to Midpoint	0	0	nd	0	0	0	4	nd	0		0				nd	0	0		
R3 - George Allen to "Cabin Hole"	nd	0	nd	1	nd	0	0	0	0	0	4	0			nd	0	0		
R4 - Townsend Gulch to George Allen	0	0	0	0	0	2	nd		0	0	0		0		0		0		
R5 - Bridge Flat to Townsend Gulch	1	0	4	6	0	0	0	0	0	0	0	0	0		nd	0	nd		
R6 - CDFG Weir to Bridge Flat	4	2		1		1	0 ¹	0	0	0	nd	0	0		0	0	0 ¹	0	
R7 - USGS Gauge to CDFG Weir				0		0		0		0							0	nd	
R8 - Blw Meamber Bridge to USGS Gauge										0						nd			0
R12 - Sweezy to Eller Lane ²																			
R13 - Horn Lane to Sweezy ²																			
R14 - Youngs Dam to Horn Lane ²																			
R15 - Fay Lane to Youngs Dam ²																			
R16 - Callahan to Fay Lane ²																			

*nd = no data (surveys performed, but steelhead count not reported; number likely 0)

¹Reach 6 completed over several days; therefore, some fish may have been counted twice

²Due to drought conditions, valley reaches did not reconnect to lower mainstem until after Fall Chinook spawning - therefore, no surveys were conducted

Appendix D – Redd Spatial Distribution and Density

Redd density on maps is displayed as number of redds observed per approximate 100 meter of survey. Where tributaries were surveyed, only those which recorded redds are included in this appendix.

Salmon River Data

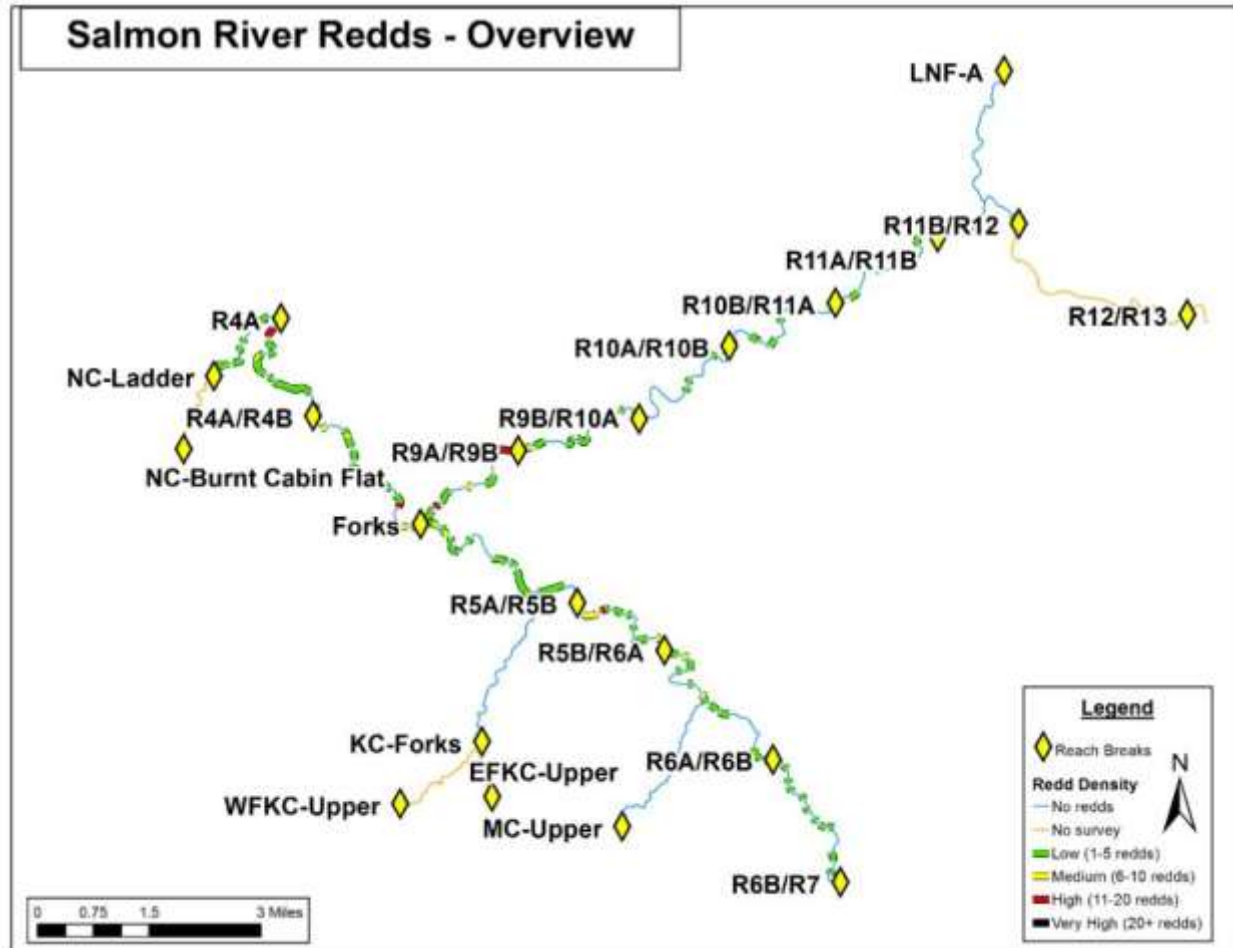


Figure D-SA1. General overview of redd distribution and density for Salmon River surveys. Map is of survey area only and does not include roads, hillslopes, or other landmarks.

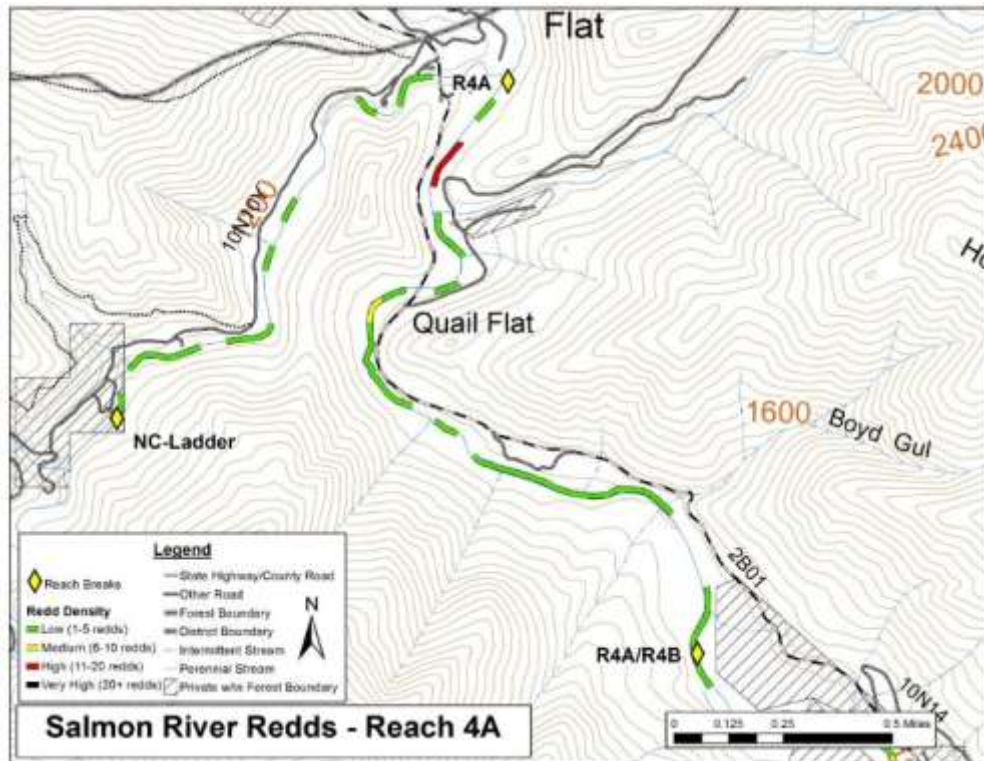


Figure D-SA2. Redd distribution and density for mainstem Salmon River, Reach 4A.



Figure D-SA3. Redd distribution and density for mainstem Salmon River, Reach 4B.

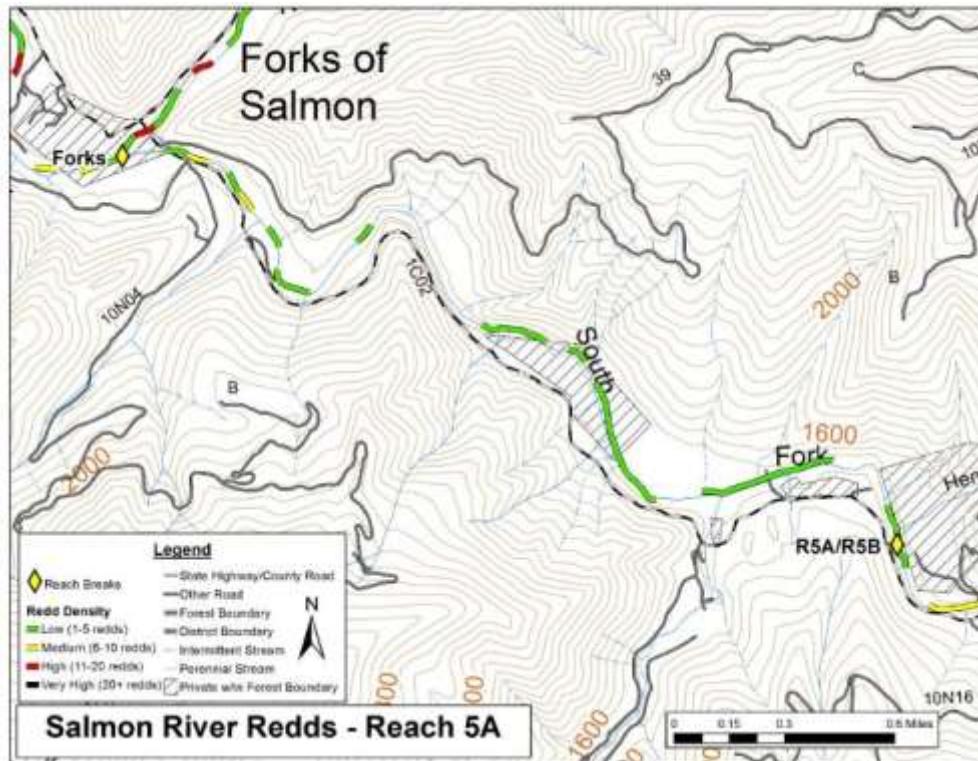


Figure D-SA4. Redd distribution and density for SF Salmon River, Reach 5A.

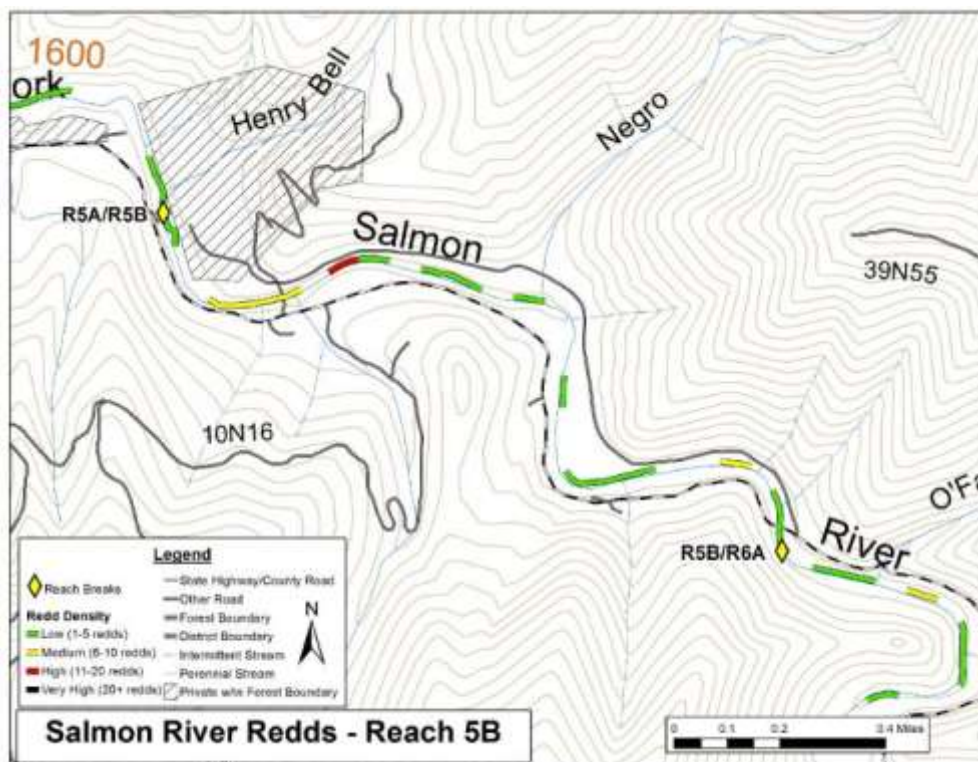


Figure D-SA5. Redd distribution and density for SF Salmon River, Reach 5B.



Figure D-SA6. Redd distribution and density for SF Salmon River, Reach 6A.

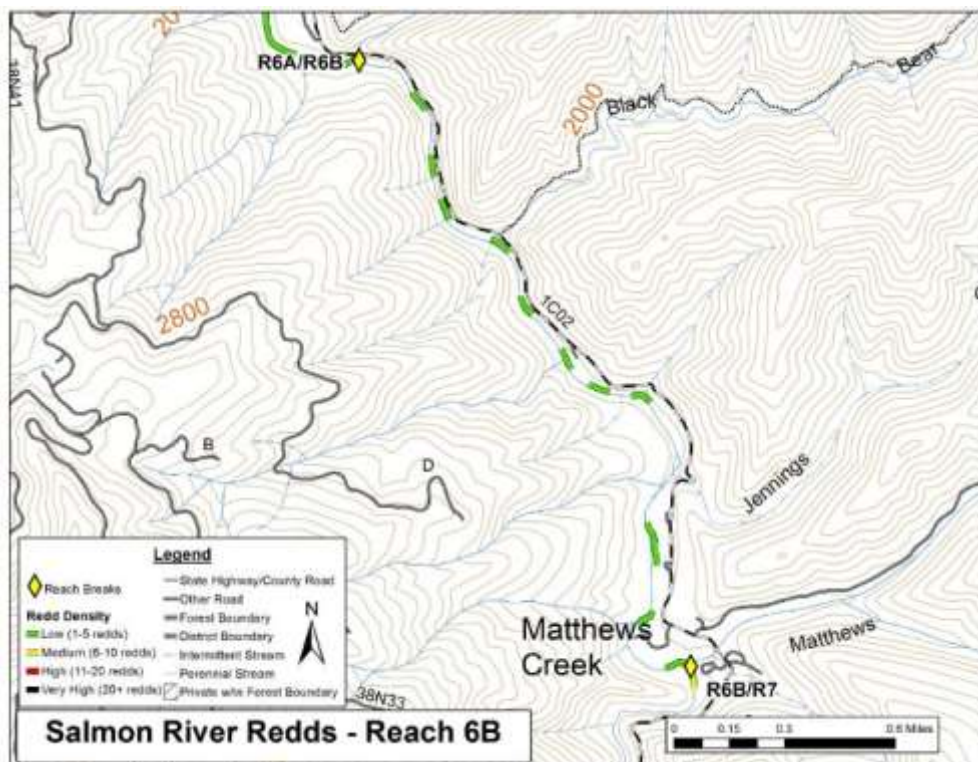


Figure D-SA7. Redd distribution and density for SF Salmon River, Reach 6B.

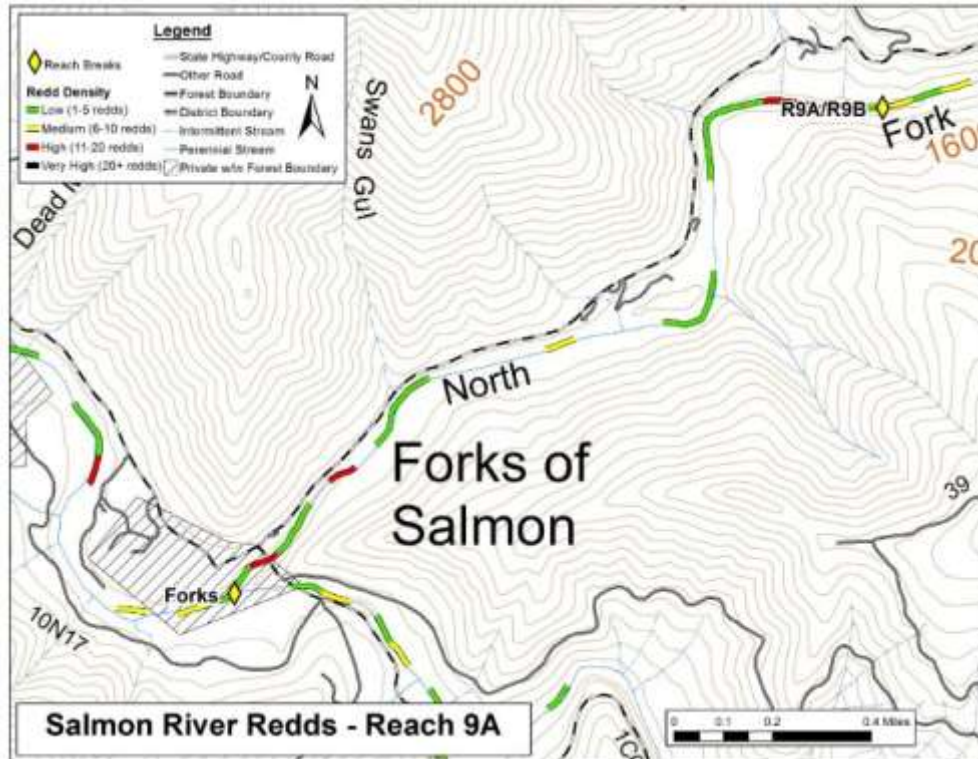


Figure D-SA8. Redd distribution and density for NF Salmon River, Reach 9A.



Figure D-SA9. Redd distribution and density for NF Salmon River, Reach 9B.

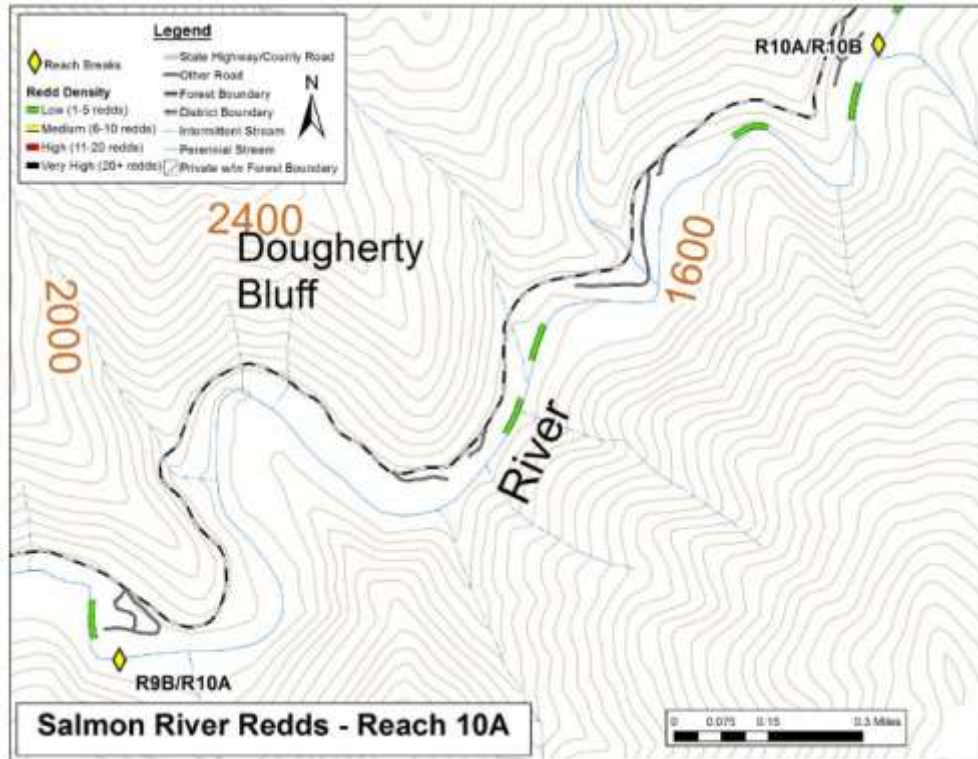


Figure D-SA10. Redd distribution and density for NF Salmon River, Reach 10A.

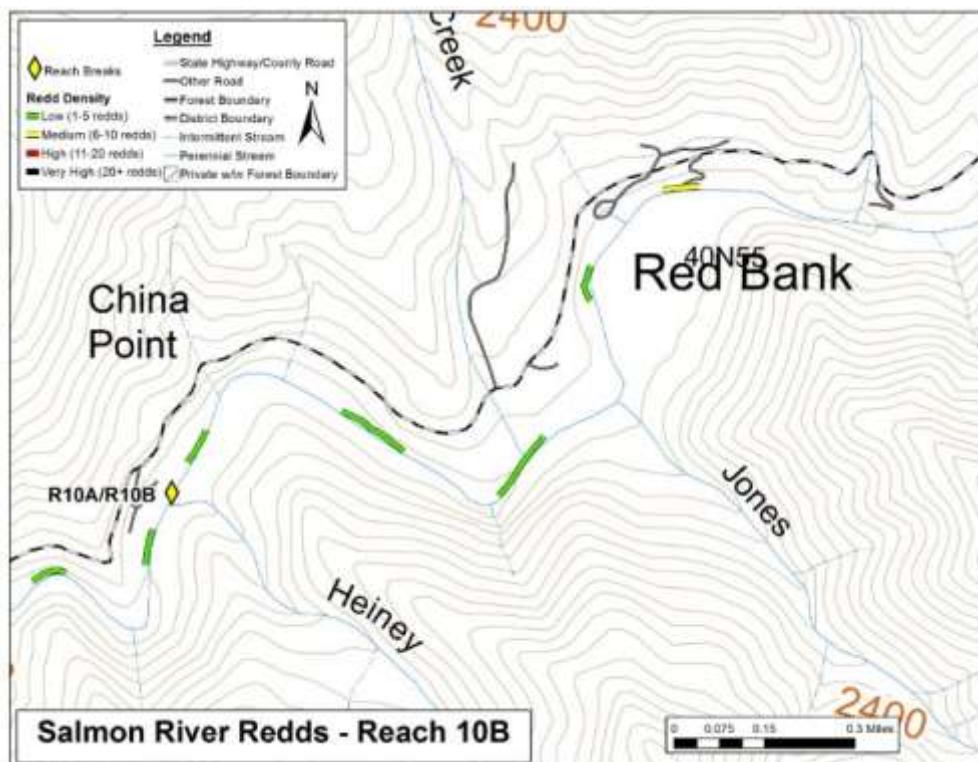


Figure D-SA11. Redd distribution and density for NF Salmon River, Reach 10B.

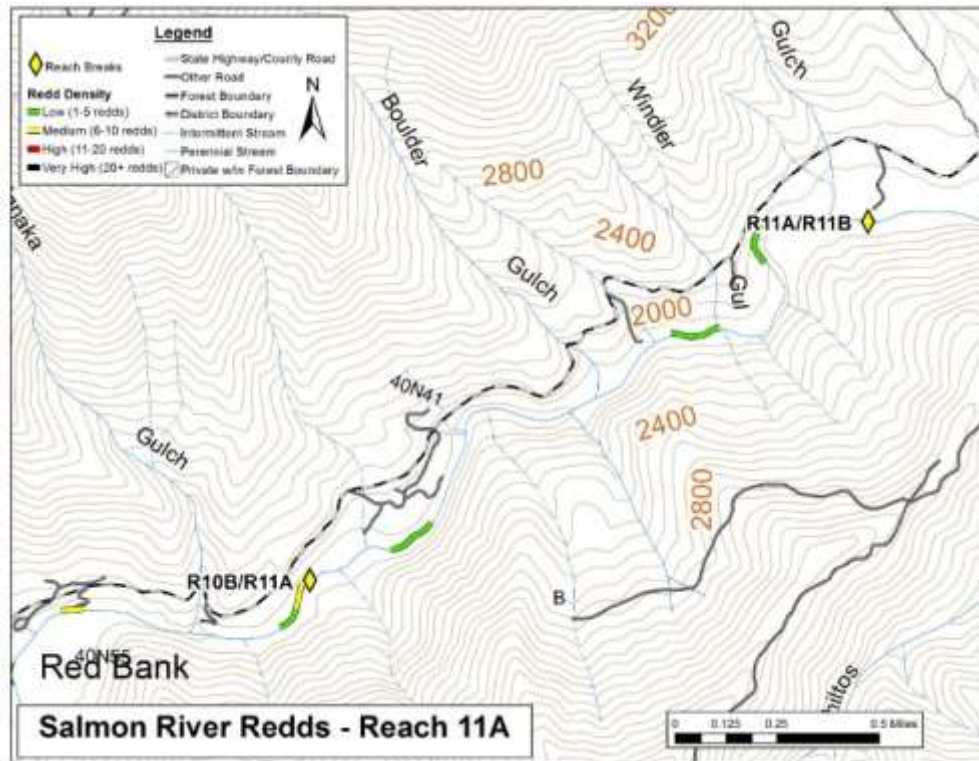


Figure D-SA12. Redd distribution and density for NF Salmon River, Reach 11A.

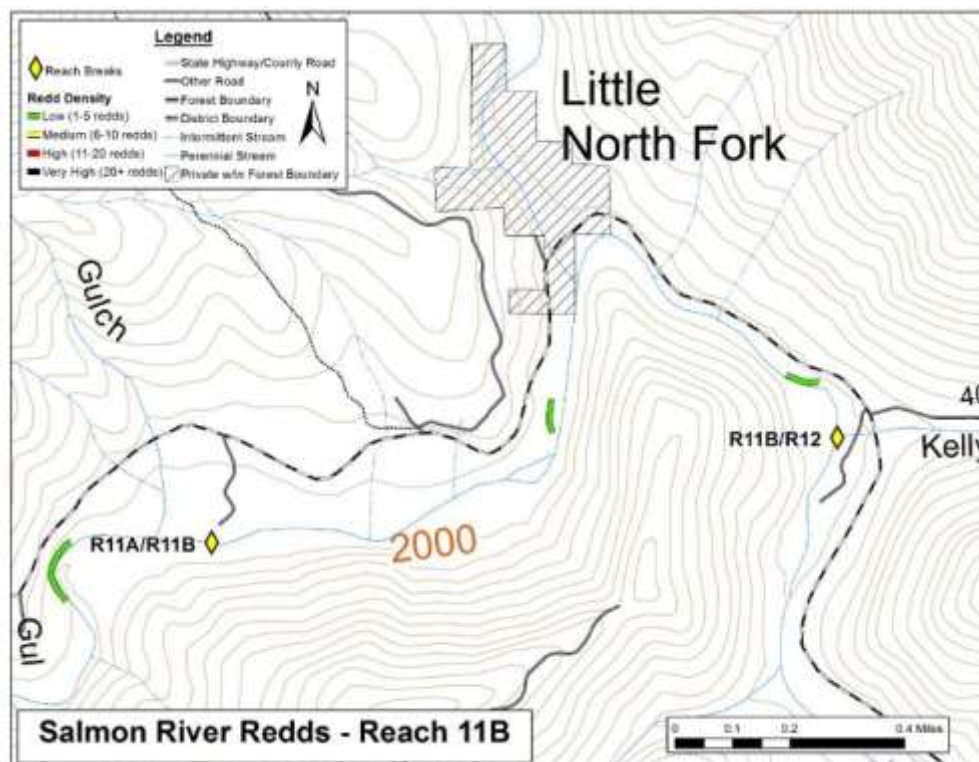


Figure D-SA13. Redd distribution and density for NF Salmon River, Reach 11B

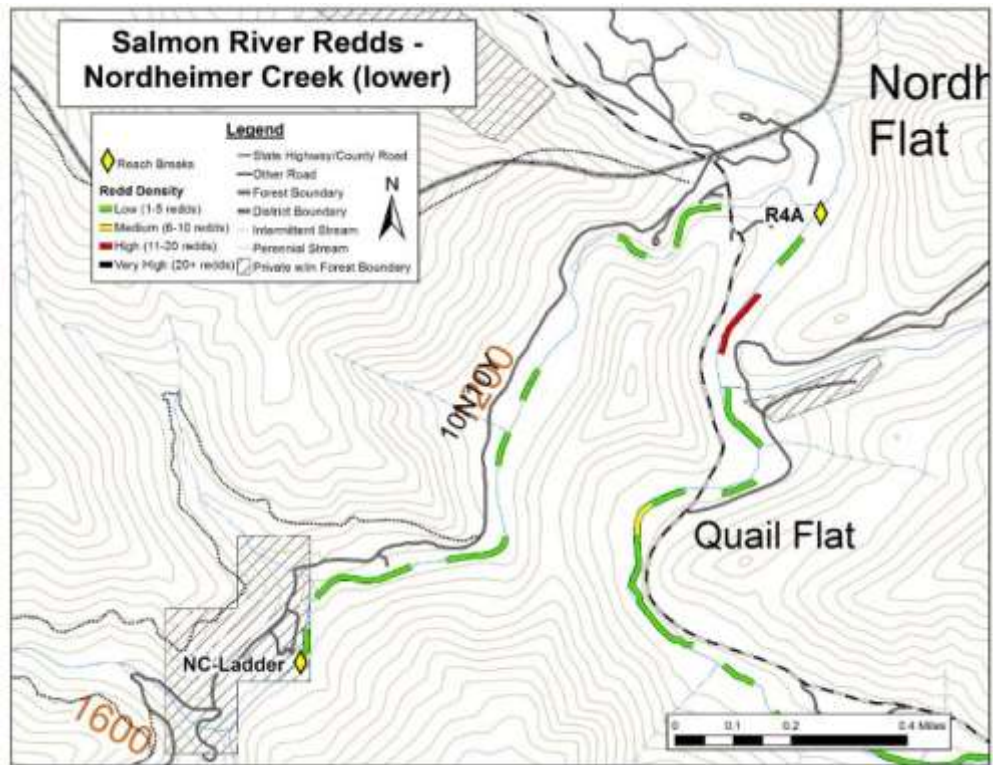


Figure D-SA14. Redd distribution and density for Nordheimer Creek (lower).

Scott River Data

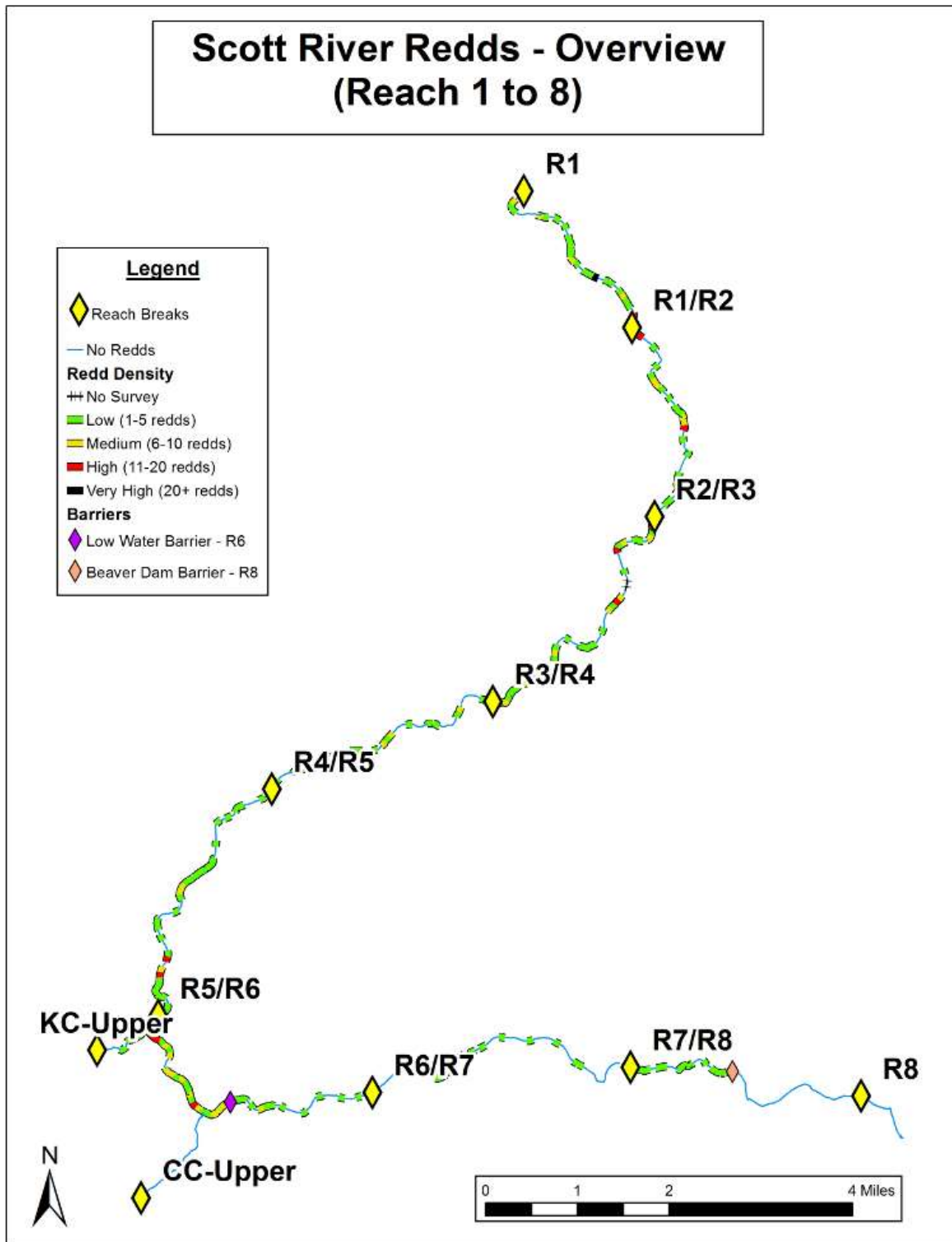


Figure D-SC1. General overview of redd distribution and density for Scott River surveys, Reach 1 through Reach 8. Map is of survey area only and does not include roads, hillslopes, or other landmarks.

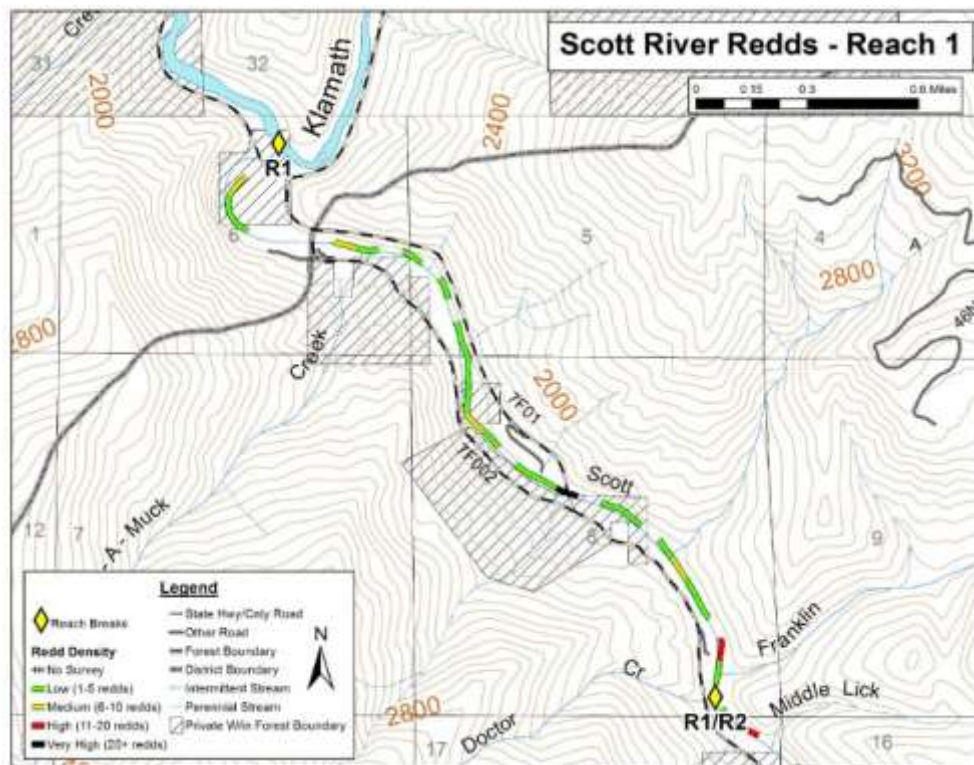


Figure D-SC2. Redd distribution and density for Scott River, Reach 1.

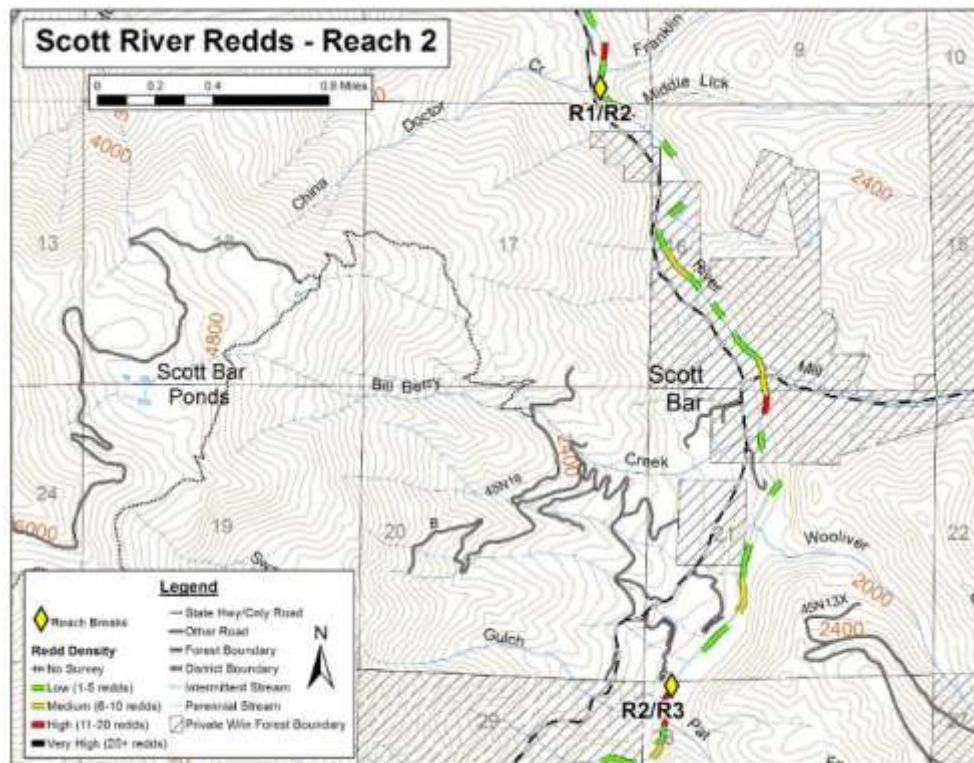


Figure D-SC3. Redd distribution and density for Scott River, Reach 2.

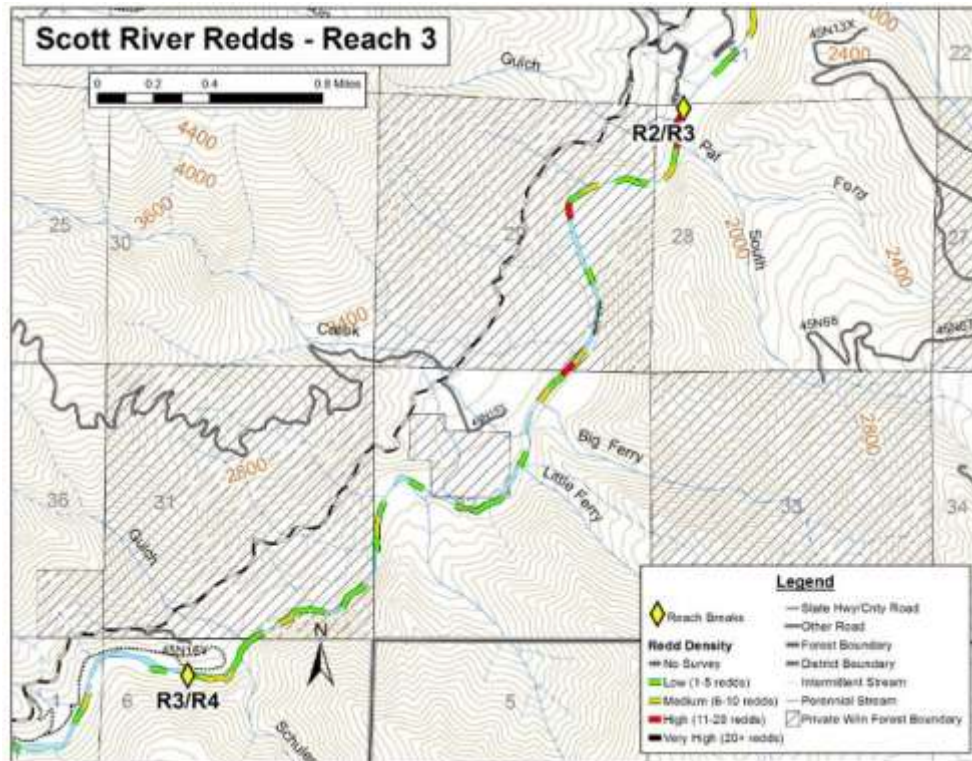


Figure D-SC4. Redd distribution and density for Scott River, Reach 3.

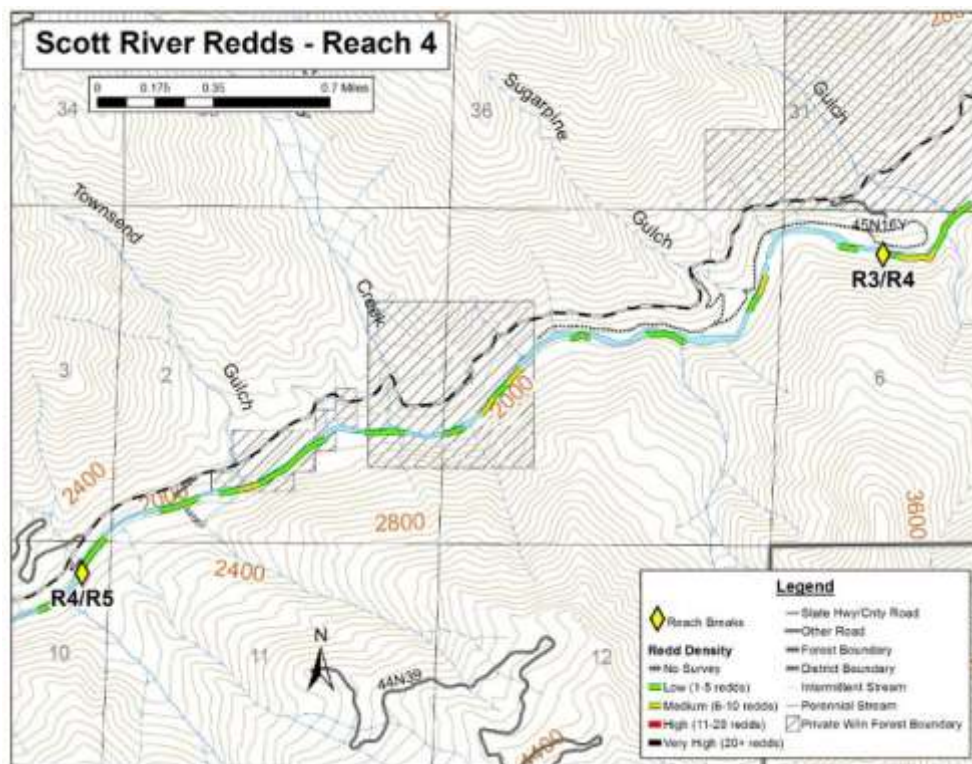


Figure D-SC5. Redd distribution and density for Scott River, Reach 4.

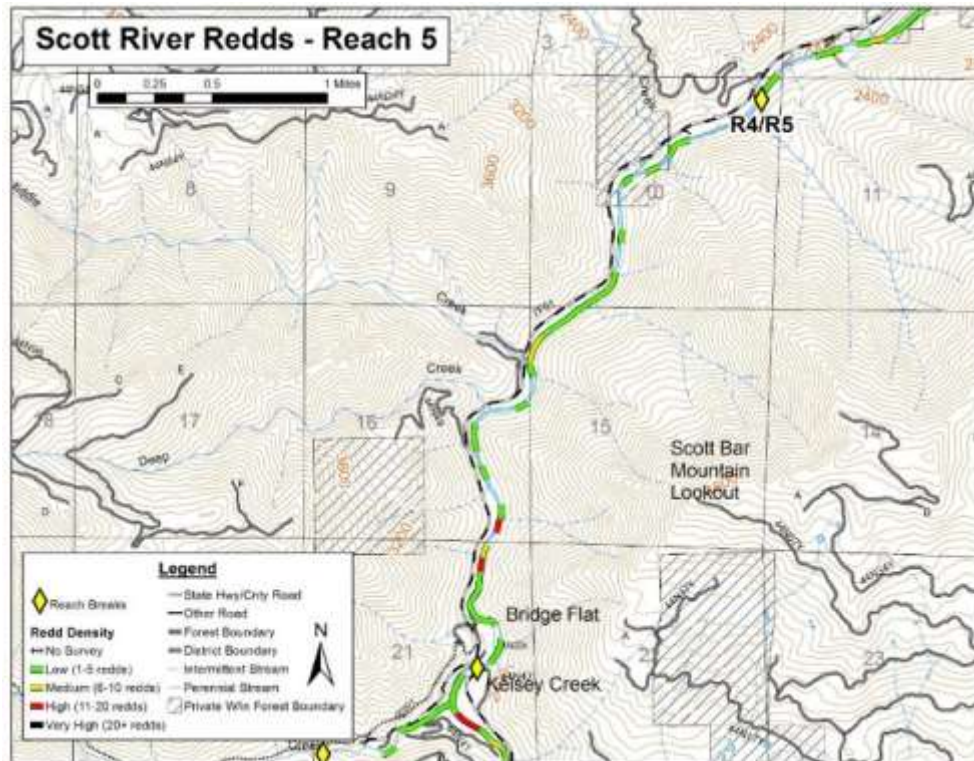


Figure D-SC6. Redd distribution and density for Scott River, Reach 5.

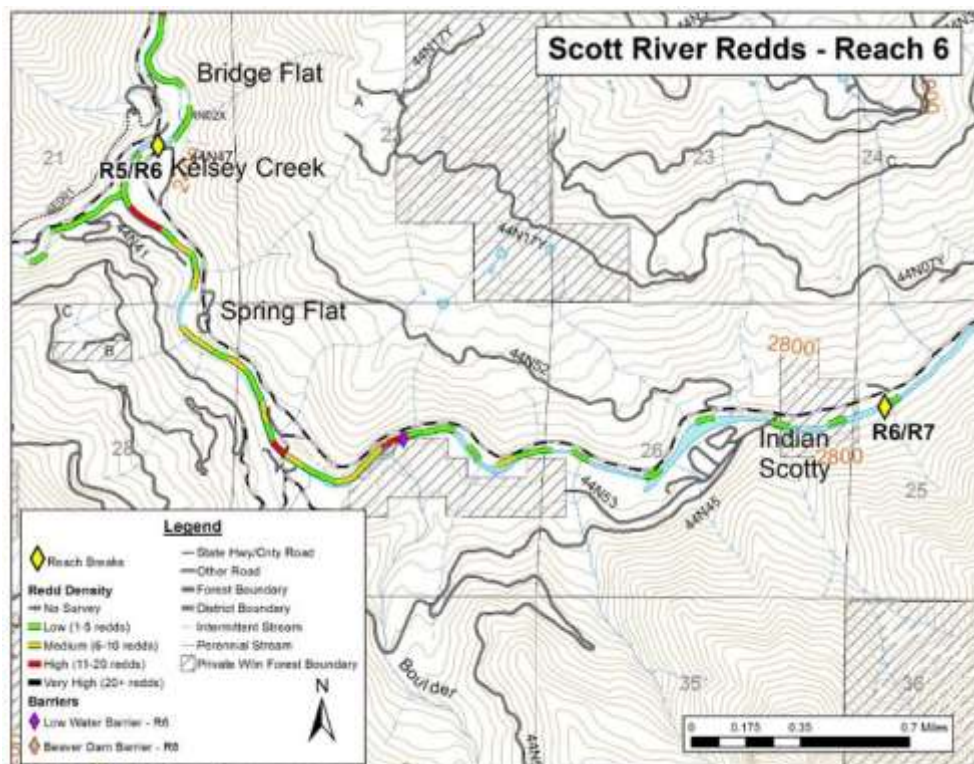


Figure D-SC7. Redd distribution and density for Scott River, Reach 6.

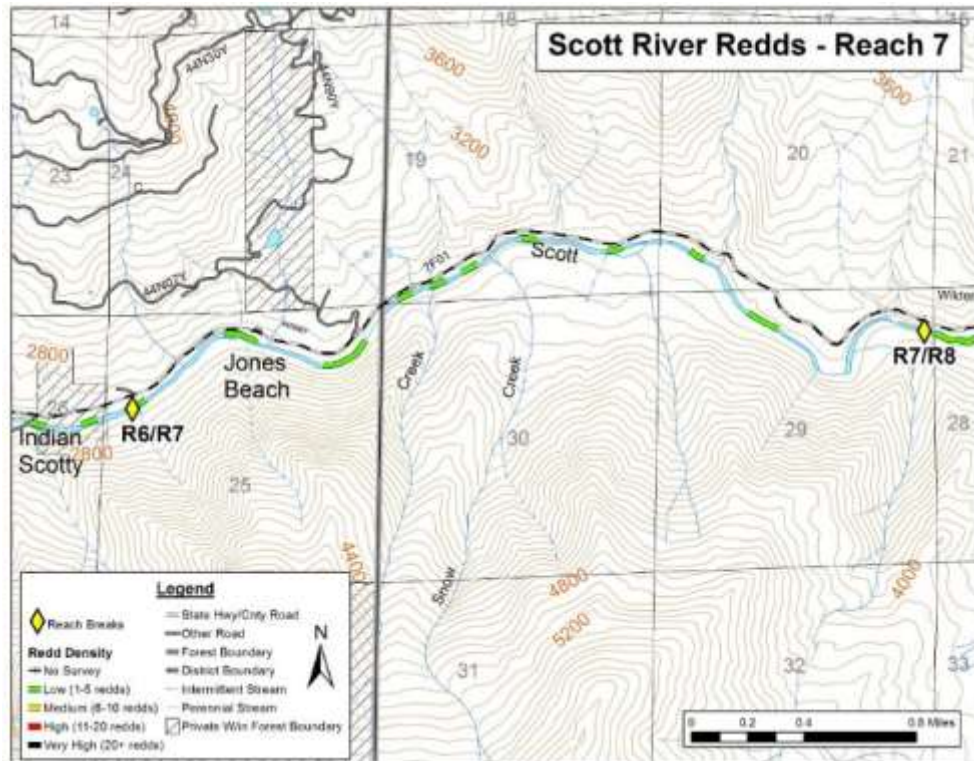


Figure D-SC8. Redd distribution and density for Scott River, Reach 7.

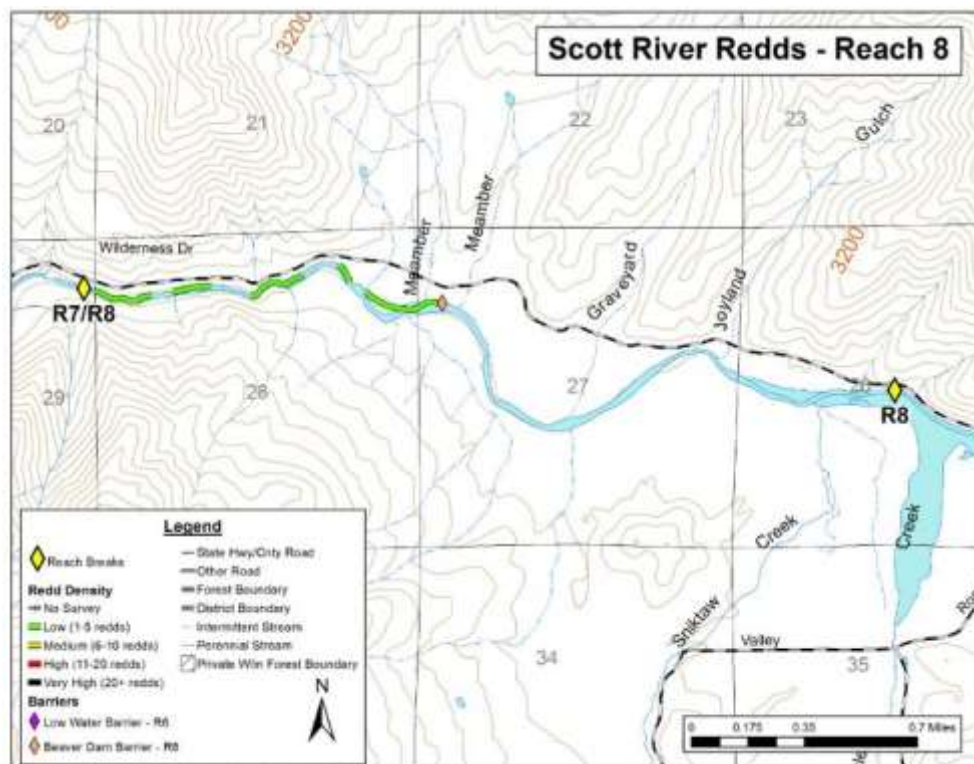


Figure D-SC9. Redd distribution and density for Scott River, Reach 8.

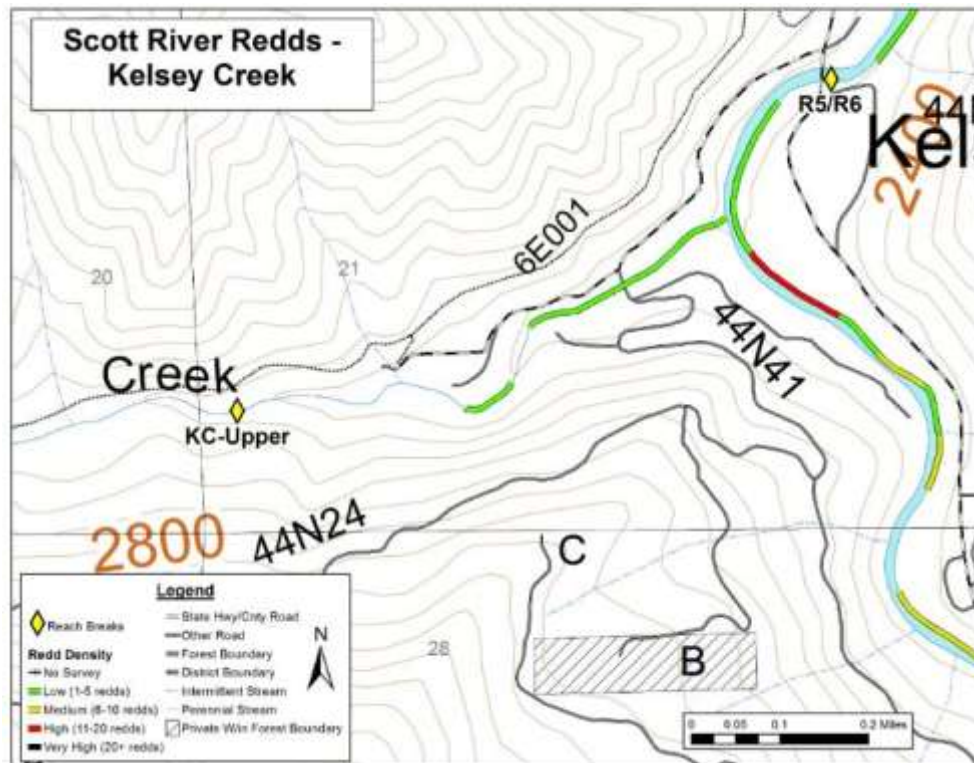


Figure D-SC10. Redd distribution and density for Kelsey Creek.

Appendix E – List of Cooperators and Contributions

Federal

U.S. Fish and Wildlife Service

U.S. Forest Service

- Klamath National Forest
- Six Rivers National Forest

State

California Department of Fish and Wildlife

- Arcata Office
- Yreka Office

Tribal

Karuk Tribe

Yurok Tribe

Quartz Valley Indian Reservation

Other

Local volunteers

Junction School District

Mid-Klamath Watershed Council

Northern California Resource Center

Salmon River Restoration Council

Scott Valley Resource Conservation District